THE MODEL ENGINEER

Vol. 95 No. 2359 THURSDAY JULY 25 1946 6d

Photo by] [*A. Galeota*

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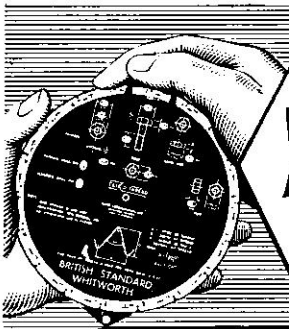

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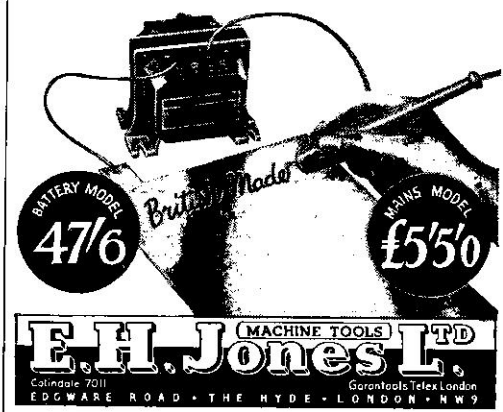

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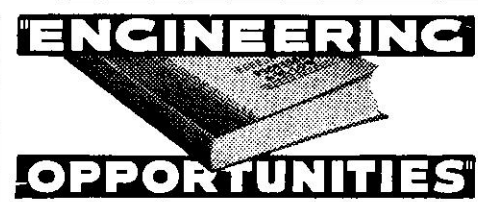

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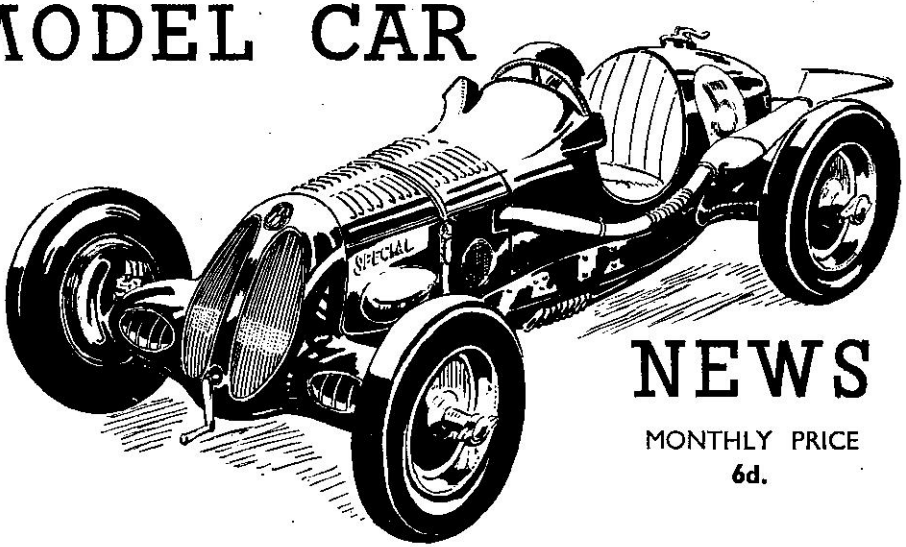

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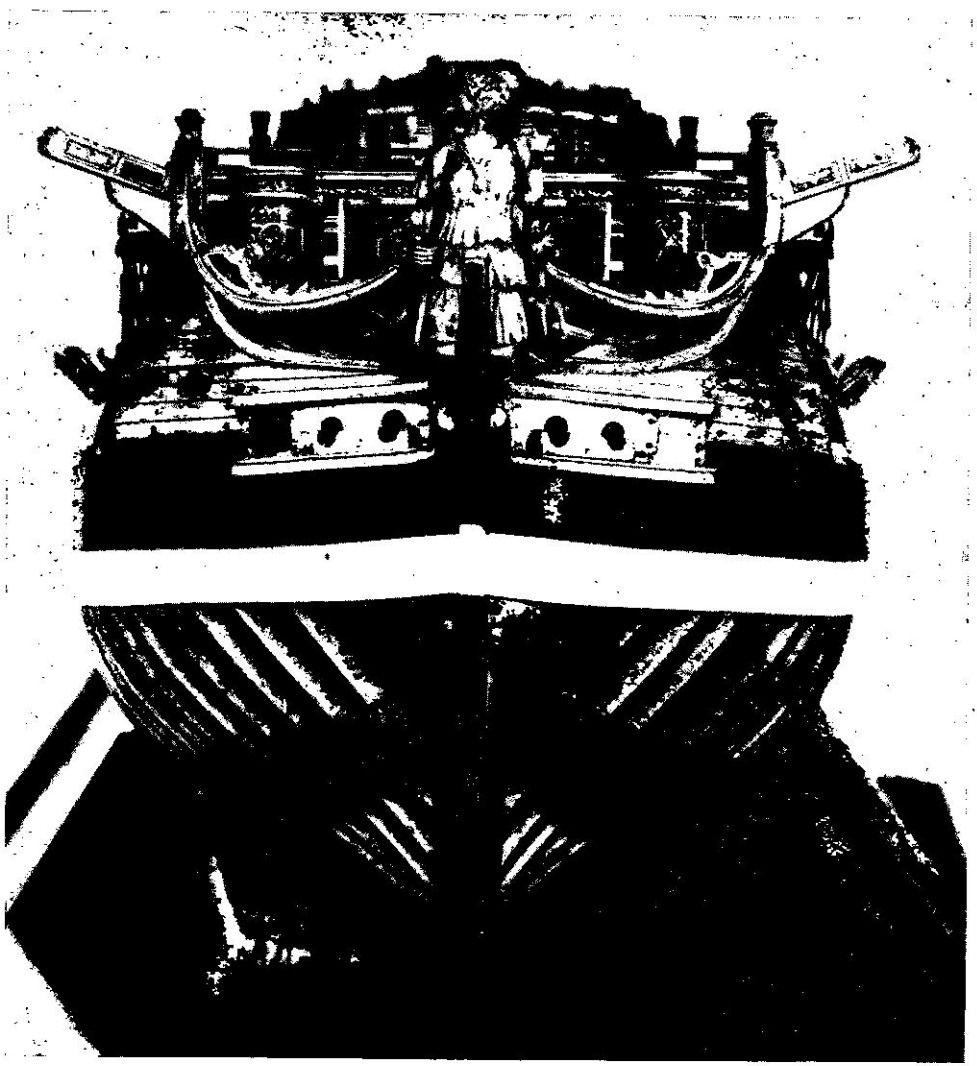
*H.M.S. "PORTLAND"

to 1/48th Scale By T. L. Wall

AS a rule, the upper frames averaged about an inch apart, not more, some were less. These were pegged and glued into the rabbet on top of the lower frames and spaced at the top, true all ways by distance-pieces tacked on. They were pegged, not screwed, to the lower frames because of having to fasten the main wales over the join. They tapered in thickness from $\frac{1}{4}$ in. at the bottom to $\frac{1}{8}$ in. at the top. At this stage the fore and aft cotton was replaced by a wooden batten about $\frac{3}{8}$ in. wide and $\frac{1}{8}$ in. thick.

The distance-pieces between frames were screwed to this batten to maintain them in place and keep them true. After that it was merely a question of planking up with planking of the correct scale width and thickness. Incidentally, all planking, inboard and out, varies in thickness according to its position, and this variation

*Continued from page 57, "M.E.," July 18, 1946



Bow view of the model H.M.S. "Portland." Students may note that the figurehead has no connection with the name of the ship

Stern view of the model H.M.S. "Portland." The decoration of the upper gallery is "strap work," lower gallery and transom painted, coat of arms and rudder-head painted and carved

shows. As the sides were planked so the beams and their knees for each deck were put in. The model is best built up deck by deck, starting with the orlop, in step with the side planking, or it will be difficult to fasten in the beams and knees, the side planking being brought along at the

same time ; it is all a question of being able to hold up against putting the fastenings in.

Fastening down the deck planking is not easy, as the beams spring in spite of their pillars. Holes were drilled through deck and beams and soft wood pegs, made from " Swan " vestas, about 3/64 in. dia., a tight fit in the holes. Drill a suitably-sized hole in a piece of hacksaw blade, previously softened, harden, and push the match through. These pegs were glued and tapped home, the beams underneath being held up with a metal bar as large and heavy as can be got in, hooked over at the end. Needless to say, where nails or pegs are hammered home the opposite side should always be held up ; this is not difficult so long as the planking, inboard and out, is thought out and done in stages. A bar of steel about 2 ft. long and $\frac{3}{4}$ in. by $\frac{1}{4}$ in. passed through the frames from the opposite side was most used for the side planking. Where nails were used they were specially small and fine brass ones, and a hole was always drilled first with a small broach made from a needle ground three-sided held in a jeweller's pin-vice sticking out only the length of the brad ; leave more and the thing breaks.

The carving is comparatively easy if one can draw, that is, has a sense of form ; not so easy if one cannot. In the latter case it may work to conscript someone else to do the drawing, preferably someone good at it, and cut to their outlines.

Drawing is really only necessary for the first two stages, *i.e.* side and front views, but it helps later if the features and some details are drawn on the wood. The method followed was to choose a piece of wood with the grain favouring the shape to be carved and of a size to cover the figure. Draw in the figure side view on the wood, and remember both sides will not be alike.

Cut away wood outside the drawn lines ; this will give something like a silhouette. Then draw in front and back outlines, details are not necessary, and again cut to outline. What will emerge will look like one of those modern sculpings over which long-haired boys and short haired-girls go all goofy. After that, it is merely a matter of patiently fining down the figure to shape and finish. Jewellers' needle-files are useful for this, as they can often be got into places where a cutting-tool cannot. Another tip is to hold the work up to a looking-glass as one goes along and to look at it in the glass ; this shows up bad proportion, which one often misses, till too late, when looking at it in the ordinary way. Only work when in the mood and under no circumstances or temptation use plastic wood. The best tool for the job is a really good penknife with different sized blades ground, honed and kept razor sharp ; and razor sharp means just that. I cannot do any good with the ordinary leaf-shaped blade ; one seems to do all the work with the point. I use a razor-hone and they vary in quality ; it may be necessary to buy two or three to get a suitable one, but they are quite small. Shaving-soap lather makes a good lubricant. When bought, the angle of the edge is usually coarser than the flat of the blade, but I find that the best angle for such small carving is when the blade is flat from the thickness of the back of the blade to the edge. Press the blade lightly flat on the hone and move it round and round, not drawing it straight from east to west, then turn it over and do the other side, trying to give each the same dose, though this does not seem to be vitally important. I have never found it necessary to strop the blade ; in fact, if I do so, I generally seem to take the edge off.

If the blade is as sharp as it should be, there will be no need for any rough stuff, but if the knife is not properly sharp and force is used the edge will probably break, which means regrinding and spoils the blade. The moment the tool shows signs of becoming lazy, sharpen again at once ; don't press the blade into the wood, but cut with a draw and it should cut with no apparent effort at all, by itself so to speak. A few wood carving tools, V's and small gouges, varying from almost flat and about $\frac{1}{8}$ in. across to half-round about $\frac{1}{16}$ in. across, help. But such tools are a matter of individual choice, one man's favourite another never uses. It will probably be necessary to make a few special tools for special jobs, old hacksaw blades for mouldings for instance. Knitting needles are, or were, beautiful steel ; softened, they can be filed to the shape required easier than ground in these small sizes. As regards tempering, the books say, at least the ones I've got, put the tool in a flame away from the edge and watch the rainbow ; personally, I find it a lot more satisfactory to take a piece of copper about 4 in. by 3 in. and $\frac{3}{16}$ in. thick, heat it until spit goes " sist " (old fashioned, but if thought rude, try it once or twice holding it up to one's cheek immediately after, note the heat and then there will be no subsequent need to expectorate). Anyway, nothing like red-hot but so that you wouldn't take hold of it without being sorry ; then lay the business end of the tool on the copper and when it turns light yellow, the first colour it will turn, bang it into cold water. I have an idea that that is not strictly the right colour for wood-cutting tools, but it seems to do very well for mine. Many people seem to think that carving can be done with a dentist's drill ; I have not found it so.

A dentist's drill was found very useful for polishing ; one can get grand little brushes. As far as carving is concerned, it will do it better than any other way I know, and occasionally for getting into awkward shaped corners such as the space between arm and body in some positions ; but that is about all. I have an idea that using it for cutting at all is wrong and a confession of weakness on my part. Polishing such small carvings is a bit of a problem, as the rough wood looks wrong and gets dirty while one looks at it. The way I got over the difficulty was to brush on clear cellulose varnish, using no particular care, and then to brush it off with a brush charged with dope in the dentist's drill.

A garage gave me a large tube of stuff very like pink tooth-paste. I believe it was called " Konsomol " or some such name ; it was brought out by one of the oil companies for washing grease off dirty hands, and is quite smooth, not a bit gritty. Whether it was good at that job I don't know, as I never tried it ; but put on the brush and brushing off the wet cellulose I do know that it left a lovely hard surface on which no varnish recognisable as such could be seen.

Unfortunately, the tube disappeared during the war, and as I can't remember its proper name and have never seen it on sale, I have got to start all over again. I shall experiment with one of the polishes sold for polishing cellulose car bodies and hope for the best.

17th century ships generally had their carving gilded, and there was lots and lots of it. On a model of *The Charles Galley*, 1670, which I made, I tried the carving box-wood colour and polished as above, but it did not look right. Not being able to use gold-leaf, I was a bit shy of gilding ; but I got some gold dust in a glass tube, and a small bottle of what I suppose was gold size to use with it, from an artist's colour shop and played about with that. The so-called gold paint I could not do any good with at all ; but doing a little at a time, putting on the size pretty wet and then floating the gold dust on to it with a camel hair brush, gave results. One has to experiment a bit.

Then I burnished it with the end of a steel knitting needle in the dentist's drill. It passed the critics, but, of course, I never told them it wasn't gold leaf ! Gilding, especially a lot of it, is apt to look garish ; but it certainly looked better than the yellow wood did against the dead black upper-works.

I would like to find a way of mellowing-down the gold. One can buy the dust, or could, in lighter or darker shades, try which looks best. One sees notices sometimes with gilded lettering which has been mellowed, but that is done by giving it a coat of french polish over the letters, and one can't do that, or at least I can't, with tiny intricate carving. Gilding is a thing to be done with care and discretion, and after considerable thought, or the result is apt to be disappointing ; the model of the *Prince* in South Kensington is a good example of one of the heavily-gilt ships of the period. Examine her carefully, and, after a week, it is a shade of odds that all that will be remembered will be lots and lots of gold, but which ports were round and which square will be forgotten. Thank goodness, one is not bothered with that problem in 18th century ships.

Continual visits to museums and close examination of contemporary models *of the period being worked to* are of the greatest assistance. But one thing at a time !

The Built-up Ship Model, by C. G. Davis, is written by an actual ship-builder and describes in full detail the building a model of a U.S. 16-gun brig of 1775. It describes the correct method of building the ship herself, and the model is a true copy of her in all respects, not conventionalised as dockyard models were. An invaluable book for a ship model builder.

Ship Building Unvailed, 1740, and *The Ship-builder's Assistant*, 1711, both by William Sutherland, give the scantlings, etc., for the various rates about the beginning of the 18th and end of the 17th centuries. With the *Built-up Ship Model* to show how ships were built and Sutherland's two books for scantlings, most difficulties can be overcome. I doubt if Sutherland's books can be bought now, but good libraries may have them. I read them in the library of the Royal United Service Institution.

Old Ships' Figureheads and Sterns, by L. G. Carr Laughton, covers all detail and decoration as well as figureheads and sterns ; is beautifully illustrated and a mine of useful and correct information. These are the books most consulted by the writer and, though notes have been taken from many others, he would say that, given these four, a model ship builder need not look much farther ; at least, as far as His Majesty's ships are concerned. There is a splendid collection of ship models, possibly more than in South Kensington, in the National Maritime Museum at Greenwich.

Finally, I like to carve a figure of one of the crew to the same scale as the ship and stick him about as one goes along ; it gives one a wonderful sense of proportion and, when finished, the model has that look of "rightness," difficult to describe but unmistakable when there. But the figure should be carved with the same care as any other of the carving ; the more lifelike the better the result. Tool-marks should be left in wood-carving and not polished out round and smooth ; if the carving is polished as described earlier on it will not remove the tool-marks.

Model of "The Charles Galley," 1676, Scale 1/48. Note the two figures, one on fo'castle and one at quarterdeck rail to give proportion

ELECTRIC RAILWAYS WITH NO TRACK CONDUCTOR

By C. BAKER

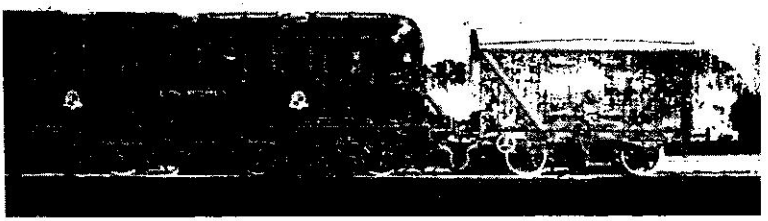


Fig. 1. The battery truck in service

OUTDOOR railways in 2½-in. gauge and over are usually intended for steam working; but, occasionally, one meets a large scenic garden layout over which electric stock sometimes runs. And, again, there are times when locomotives operate over "foreign" lines, even if it is only for demonstration purposes at exhibitions. Electrically-driven models may, in such circumstances, be handicapped by the presence of a track conductor in the wrong place or, worse still, by its entire absence, and the purpose of this article is to describe a wagon built to carry the accumulators necessary to propel a model for short periods when it is "playing away."

In THE MODEL ENGINEER for July 27th, 1939, the writer described a 2½-in. gauge electric locomotive incorporating true-to-type control circuits and equipment for use on an indoor demonstration-track, and mentioned the possibility of running the model over a layout not specially equipped, provided the electrical refinements were isolated and current was taken from accumulators carried in a truck hauled by the locomotive. A description of the truck was also promised for a later issue of THE MODEL ENGINEER, but by the time the vehicle was got into running order, hostilities had broken out and the pressure of war work so impeded model activities that this is, in fact, the belated article; it is hoped, however, that it still describes a model with a wide range of usefulness.

Fig. 2. Loading the batteries

Consider first the specification with which the wagon was built to comply. It was to carry two accumulators, each 4-volt, 3¼ in. long by 2½ in. wide by 3 in. high; also a control switch, a simplified accelerating relay (or switch), a variable resistance and a trip-switch for actuation by a crude form of fixed "train stop" on the track. A fair degree of realism in external appearance was also demanded, and it will be seen from Fig. 1 that this was achieved.

The locomotive was of Metropolitan prototype, finished in the original colours and, since the Company worked some goods and service trains electrically, a Metropolitan box-van was considered most appropriate for the "power station." To facilitate loading, end-doors were considered the most practical, since the accumulators could be slid straight in on a shallow ebonite tray, an operation which is, in fact, shown in Fig. 2. There is not much room to get one's fingers into the van, although it has been made a little wider than the average, and advantage has been taken of a smooth planked exterior with simple cardboard strapping instead of deep outside metal framework. So the two sides, the fixed end and the roof are made of four separate pieces of wood. The sides and ends are of ⅛-in. mahogany and the roof 1-mm. three-ply stiffened by several roof sticks cut from ¼-in. plywood. The double end-doors and the base are cut from ⅛-in. three-ply, the former being hinged outward and locked with the usual type of lever-bolt, for which 16 s.w.g. wire was found suitable. The

planking is scored on and dummy side doors indicated, whilst the hinges are represented by cardboard strips. The inside is finished with aluminium paint, which makes the accumulator connections easier to see, and the outside, although not a true replica of an actual vehicle, is painted dark-grey and lettered in the old Company's style.

The spoked wheels are cast-iron and the journals run in brass boxes sliding in mild-steel plate axle-guards. A hinged cover is provided over the oil-hole in each box. The model "springs" are cut from aluminium bar, but the bottom of the buckle is recessed, and likewise the top of the axle-boxes, to accommodate a short length of working steel coil-spring.

Dummy brake-gear, consisting of aluminium blocks and mild-steel rigging, is fitted. The buffer-heads and bodies are turned from steel bar; at the end of the wagon, under which most of the switch-gear is housed, they have individual compression coil springs; but, at the opposite end, where more space is available, advantage was taken of using a leaf-spring made from an old alarm-clock part. It combines the buffers with the draw-gear and extends right across the vehicle, as shown in Fig. 3, following the system commonly adopted in real practice.

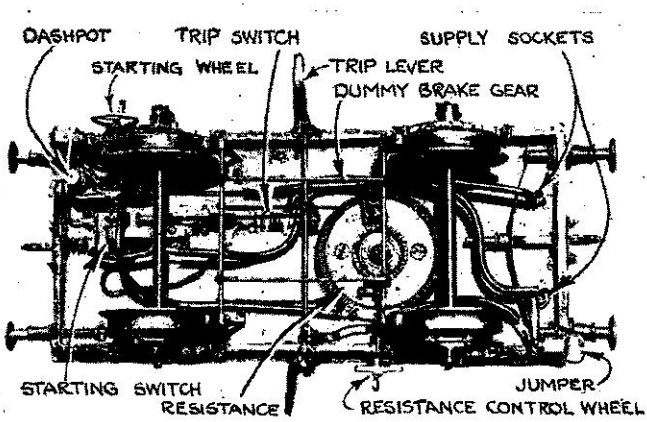


Fig. 3. The underside of the truck

Having disposed of the mechanical construction, we arrive at the electrical arrangements The obvious method with a direct feed was adopted. The accumulator leads plug into two sockets recessed in the floor immediately inside the end doors, and from the terminal nuts on underside, the supply is taken through the switchgear (described later) to a scale model jumper connection fitted under each headstock below one of the buffers; the jumper cable from the locomotive plugs into this, as in real practice.

Other methods may be preferred by some people to meet special conditions. In the case of a steam-outline model, for example, it would look more realistic to run a twin-core flexible lead inside a length of rubber tubing representing the vacuum-brake hose and so dispense with obvious electric cables between the vehicles. And again, the use of a single line from the accumulator and an earth return from the locomotive through the track has interesting possibilities, but cannot be recommended for general use. It means cleaning and bonding the rails, work usually neglected on outdoor steam railways; but it permits a limited degree of remote control. Clearly a break in the rails connected by a switch or variable resistance can be used to stop or start a train by arranging the locomotive and battery truck to bridge the break. And if the whole line is broken up into lengths shorter than that of an average train (assuming the locomotive and battery truck to be at opposite ends, making the sections as long as possible) the train can be operated quite easily anywhere on the layout. But such an arrangement, offering few advantages over orthodox conductor or two-rail systems, has only limited possibilities and is not destined to enjoy wide popularity. It strains the usefulness of a battery truck beyond that of occasional running, for which it is primarily intended.

Returning to the actual model, the arrangement of wiring and switch-gear under the truck can be followed from Fig. 3. The starting-switch fitted to the underside of the floor is closed manually by a small wheel at the end of a cross spindle suspended from the solebar and is opened by trip-levers on each side of the truck arranged to engage with a fixed stop, such as a nail or a piece of stone, on the track. The wheel is fitted with a scale-size turned handle and is painted white, giving the appearance of a hand-brake wheel of the type commonly found on bogie wagons in real practice. When the handle is at the bottom or top of the wheel (6 o'clock or 12 o'clock) the contacts are closed, and at positions more than 20 deg. from them they are open; but the wheel does not move when the switch is tripped; under that condition the circuit is broken at the main switch. To start the train after tripping, the wheel is turned clockwise through 180 deg. (i.e. to the diagonally-opposite "ON" position); this closes the contacts of the main switch and so resets the trip.

A half-speed condition is obtained by means of a resistance; under ordinary running conditions it cuts out automatically after a few seconds' running, but it can be arranged to remain in circuit continuously if the control-wheel handle is used in positions corresponding to 5 o'clock and 11 o'clock. A dash-pot is provided and so set that at 6 and 12 o'clock the plunger is lifted and allowed to fall, thus creating a time lag; but it is mechanically held in the up position when the wheel is in the 5 and 11 o'clock positions, and the train continues to run at half-speed. The

resistance is variable and can be altered by turning a second hand-wheel on the opposite side of the truck. Once more, it is designed to represent the hand-brake. It is not manipulated when the train is working; it is only intended to govern the rate of acceleration or the slow running speed and is, therefore, pre-set.

The methods of effecting these operations can be followed by reference to Fig. 4; it shows diagrammatically the essential mechanism and indicates the wiring as viewed from the underside, and most of the items can be seen on the companion photograph. All the spindles are made from $\frac{1}{16}$-in. mild-steel bar and run in bearing brackets cut from 16-s.w.g. brass sheet. The trip-spindle runs right across the wagon, and the brackets, which are V-shaped, are fitted to the solebars with 10-B.A. bolts. Since the spindle must always rotate in the same direction to actuate the main switch by the simple crank adopted, the trip-lever on one side drives the spindle through two brass pinions mounted on the bracket. Both trip levers actuate the spindle by means of secondary levers which they engage with a striking pin, as shown in Fig. 4, and they are free to rotate on the shaft so that they can trail over the train stop when the truck is running in the reverse direction. The levers are cut from 16-s.w.g. steel plate. The spindle crank-arm is pinned to the resetting push-rod which carries one of the main switch contacts by means of a small fork-end soft-soldered in position. The contacts are cut from silver sheet and shaped to ensure that they positively lock into each other when they are closed; the moving contact is screwed to a fibre block clamped to the push-rod.

An extension of the rod terminates with a striking-plate which engages with a cam soldered to the starting-spindle; the latter is parallel to the trip-spindle, but extends only halfway across the truck. Another similar cam lifts the plunger of the air dash-pot which serves the purpose of an accelerating relay. The plunger is $\frac{1}{4}$-in. diameter brass soldered to a silver contact disc and is a good sliding fit in a brass cylinder. (When the pressure between contacts is light, silver is an excellent material and a small piece can often be cut from an unwanted ornament or trinket.) A small cock is fitted at the bottom of the cylinder to control the escape of air. The plunger is greased and its rate of falling is controlled by the cock so that the acceleration can be set as desired. The action of the dash-pot can be followed from Fig. 4, but it must be remembered that, to conform with the photograph, it is drawn upside down.

The closing of the circuit for starting is effected through a starting-switch made from a commutator taken from a "OO"-gauge motor and pressed on to the spindle. Ordinary brass contacts have proved satisfactory in this case.

The starting spindle must always be rotated in the same direction to prevent the dash-pot cam fouling; so a ratchet-wheel taken from an old clock is also fitted. This also serves as a stop to keep the spindle in its "ON" positions and "half-speed" positions—one tooth in advance—in which the dash-pot plunger is held from falling, although the "commutator" contacts are just long enough to engage.

The remaining equipment consists of a resistance wound on an asbestos former and controlled by a spindle driving a pinion and crown-wheel to

(*Continued on page* 88)

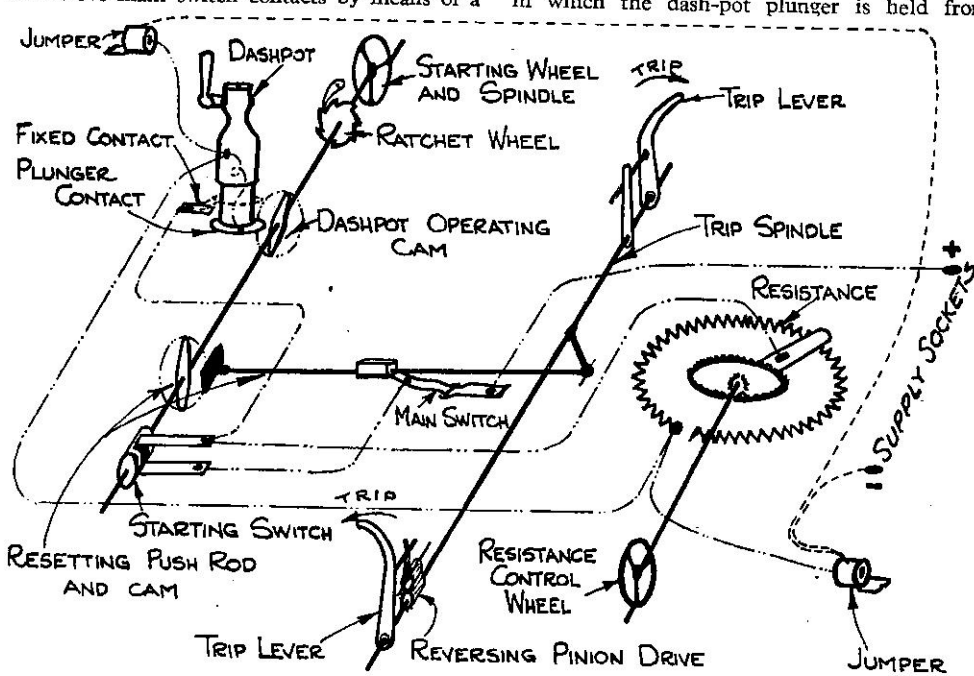
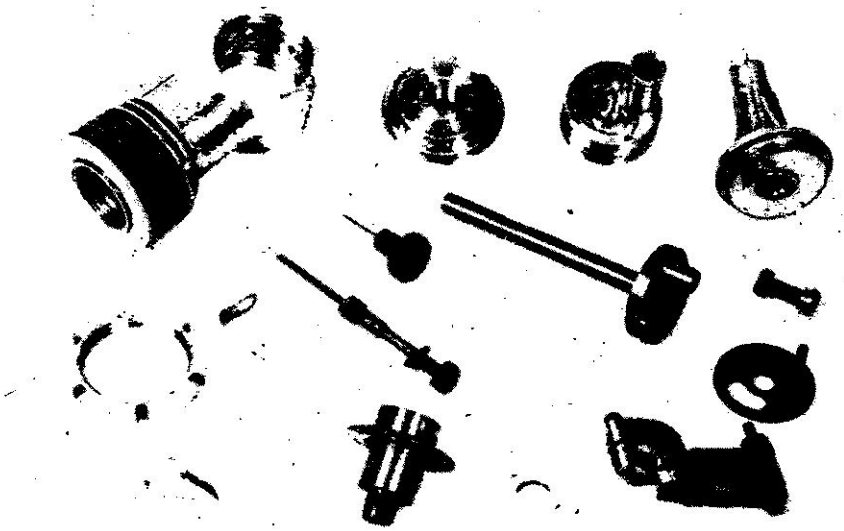


Fig. 4. Diagram of the equipment and wiring

★ PETROL ENGINE TOPICS

CARVING OUT A TWO-STROKE

By EDGAR T. WESTBURY



The component parts of the "Zephyr" 2½-c.c. engine

THE pivot for the rotary valve consists of a steel screw having the shank screwed 8-B.A. for a length of $\frac{7}{16}$ in., a plain portion $\frac{1}{8}$ in. diameter by $\frac{1}{16}$ in. long to fit the bore of the valve disc, and a thin head, with screwdriver slot, $\frac{5}{16}$ in. diameter. I have not considered it necessary to show a detail drawing of this screw, as its function and dimensions will be fairly obvious. The bearing portion of the screw should be case-hardened, and when the valve is assembled, the screw is adjusted to allow the disc to run freely but without appreciable end play, then locked by means of a nut on the outside of the rear housing.

Connecting-rod

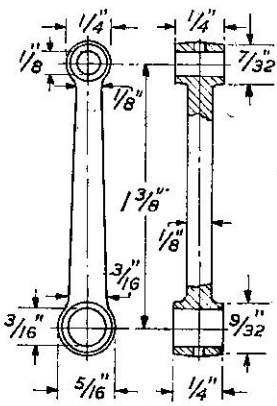
This should be made of duralumin, if available, but failing this, bronze or steel may be used, though in the latter case, it is necessary to case-harden or bush the two eyes. The methods of making connecting-rods from the solid have been described several times in describing other engines, and any of these methods may be used with success in this case. Turning the main contour of the rod between centres is one of the most straightforward and expeditious methods; it leaves the sides convex instead of flat, but this is no disadvantage, as it detracts very little from the strength of the rod, and tends rather to improve the appearance. The important thing in any connecting-rod, however, is that the two eyes should be in correct alignment, and this is just as important in a tiny rod as a large one. If the rod is clamped to a piece of flat bar, using small vee-pads and packings of suitable thickness to keep its axis parallel to the bar, the two holes can be drilled with the assurance that they are properly aligned in both planes, by mounting the assembly on the lathe faceplate and centring each of the eyes in turn. The front of each boss can be machined while set up for boring, and the reverse side can be turned by mounting the eyes on pin mandrels; after which, the surplus material at the sides of the rod, between the eyes, can be removed by turning, milling or filing.

I have not shown the rod fluted at the sides, though this can be done at the option of the constructor. It should be regarded rather as a refinement than an actual advantage, as the very small amount of metal removed will make very little difference to the engine balance or performance. But it is certainly worth while to the constructor who is concerned with the appearance of things which "don't show," just as much as with the external appearance.

Before making the connecting-rod, it is a very good policy to check the leading dimensions of essential parts, in case there may be any minor discrepancies affecting the length of the rod. It is my experience that these are the rule rather

★ *Continued from page* 28, "*M.E.*," *July* 11, 1946.

than the exception, however carefully one works ; and I find it worth while always to make up a dummy connecting-rod, which can be used to verify such important things as port timing. Should one find when checking up with the dummy rod that the port timing is, say, 1/64 in. out, it is a simple matter to make the actual rod 1/64 in. longer or shorter between the eye centres to correct the error.



Connecting rod

Piston

This component, like the cylinder liner, may be made either from cast iron or steel, and in this case also, the former material is recommended if one is in any doubt about actual properties or correct heat-treatment of the available steels. In any case, it is a rather fragile component, as the lower part of the skirt is only 1/32 in. thick, and must therefore be handled with due delicacy. It will be found most convenient to machine it from a stick, having a fairly comfortable extension for chucking, and to carry out the internal and external turning at one setting, also shaping the contour of the top to form the sides of the deflector, but not parting off at this stage ; a substantial neck should be left for subsequent handling. The end forming the chucking-piece should, if necessary, be previously machined, so that it can be replaced in the chuck to run truly after preliminary operations have been carried out.

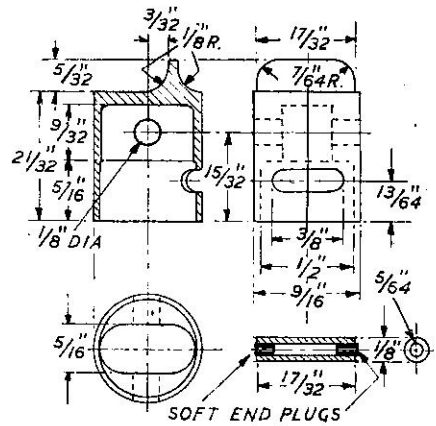
First face and centre the end, then drill ⅜ in. diameter to a depth of 19/32 in., finishing with a flat-ended bit or end-mill. Open out with a boring tool to ½ in. diameter for a depth of $\frac{5}{16}$ in., and then the outside to about 1/32 in. over the finished size. Mark out the position of the gudgeon-pin hole, 15/32 in. from the end face, with a point tool, and then, with a scribing block on the lathe bed, scribe a centre line across the diameter of the piston, producing this along each side to intersect the circumferential mark. Remove the work from the chuck, centre-punch the intersections accurately, and drill carefully from either side with a small, rigid "pilot" drill, afterwards opening out to a No. 31 hole and finishing with a ⅛-in. reamer or D-bit passed right through. With reasonable care, the hole should come out dead parallel with the piston face and exactly across the centre of the diameter.

The work should now be set up for milling the inside to form the gudgeon-pin bosses. In the absence of special milling equipment, the best way to do this is to clamp the chucking-piece on a vee block, and mount it on the cross-slide of the lathe, with suitable packing to bring the centre of the piston exactly level with the lathe centres. This may be verified by means of a bent wire held in the lathe chuck, and presented, by turning the lathe, to the top and bottom of the piston in turn ; it should touch, or show the same separation distance, in each case. The piston should also be set parallel with the lathe axis, and the gudgeon-pin holes should be in the vertical position, as may be checked by temporarily fitting a piece of ⅛-in. rod in them and sighting it from a square laid on the cross-slide.

After securing the piston in this position, a ⅜-in. end-mill is held in the chuck and used to machine out the inside of the piston. As this is necessarily "blind" work, or nearly so, the positions of the slides should be marked, by the use of the indices or other means, so that it is possible to tell when the end of the cut is reached, either sideways or in depth. "Make haste slowly" in this operation, as too heavy a cut will only cause spring and chatter, or possibly shift the work ; it is not a long job in any case, but worth taking pains over.

Next replace the work in the lathe chuck, to run truly over the outside, and turn it down to about 0.001 in. over finished size, leaving the rest to be finished with a ring lap, as described for previous engines. It is best to leave it on the chucking-piece for this operation, as this will not only facilitate handling, but also enable it to be used like a plug gauge when trying it in the cylinder. As soon as it can be inserted in the latter without using considerable force, the main lapping operation should be regarded as completed, only final finishing with rouge or metal polish being then necessary to bring it to a smooth sliding fit in the bore.

Remember that the future success of the engine may depend almost entirely on the fit of the piston in the cylinder, and spare no pains to make

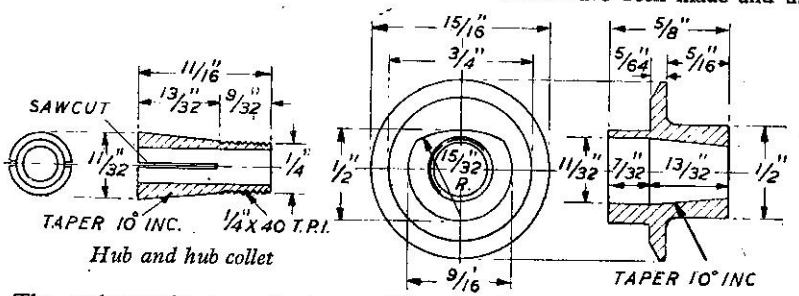


Piston and gudgeon-pin

it as perfect as it is humanly possible to [illegible]. Badly-fitted engines *sometimes* work, [illegible] fitted engines *always* work—and both in [illegible] performance, repay the trouble spent on them a hundred times.

After parting off the piston from its chucking-piece, the top surface, including the deflector, may be finished by filing. Make a clamp by drilling a piece of hardwood with a $\frac{5}{16}$-in. [illegible] and then splitting it with a saw, to hold the [illegible]

in the vice for this operation. Finish the top surface as smoothly as possible to deter the formation of carbon. It is possible to correct very small errors in port timing by filing the crown, but there is an obvious limit to the extent to which this can be exploited, as the piston may become too heavy, or the crown too thin, if it is made very much different to the prescribed dimensions.



Hub and hub collet

The gudgeon-pin is made from mild-steel, carefully machined and lapped to fit fairly stiffly in the piston bosses, and drilled 5/64 in. diameter right through. Soft plugs of brass or aluminium are fitted to the ends to avoid scoring the cylinder walls if the pin works endways. The small *bouchons* used by watchmakers for bushing pivot holes can be used for this purpose, the ends being slightly tapered with a file, and after driving them home, cutting off just proud of the end of the pin. Case-harden and polish the pin before fitting the plugs.

Propeller Hub

The form of hub which has been used on several of my engines has been retained, though many of my critics think it unduly heavy, and constructors may vary this item to suit their own preference. A steel hub is regarded as most satisfactory, especially as it is combined with the contact-breaker cam, which should be case-hardened to ensure maximum length of wear; but a duralumin hub will give fairly good results, if one is prepared to tolerate a little wear on the cam.

The hub may be turned at one setting, which will ensure that all parts are truly concentric, and in the absence of a suitable taper reamer or D-bit for finishing the bore, it should be bored out as carefully as possible with a fine boring tool. Before parting off, the work may be set up eccentrically to machine the cam surface, the exact amount out of centre being 7/32 in., though this dimension is not critical. Machine away the surface so that the period of the "make" will be approximately 120 degrees—this will be several degrees more than the actual closure of the contacts, as the clearance between them must be allowed for.

Hub Collet

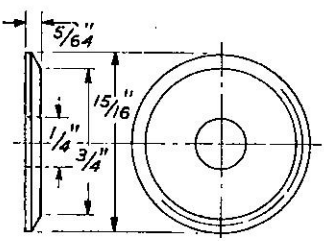
This should be made from a tough grade of steel, and the taper must, of course, correspond exactly with that of the bore of the hub. It is permissible to use a very fine Swiss file to finish the tapered surface, and Prussian blue or other marking may be used to test the true mating of the tapers.

I have heard some constructors say that this form of hub mounting is insecure, and that it gives a lot of trouble though shifting and upsetting ignition timing. There is, however, ample evidence that it gives adequate security if properly fitted, and that the ability to slip *in emergency* is a practical advantage. The number of engines of my design, possessing this feature, which have been made and used by readers of THE MODEL ENGINEER over a period of several years should be a sufficient answer to criticism on this point. If any constructor finds it impossible to obtain satisfactory results with this type of fixing, the reason is to be found in his methods or workmanship, rather than in the design.

The end of the collet is screwed ¼ in. by 40 t.p.i., to take a special nut, which may, if desired, embody a bullet-nose or "spinner," and the centre of the collet is drilled and reamed $\frac{5}{16}$ in. diameter; it should fit rather stiffly on the crankshaft. After parting off, the collet is slit up both sides as far as the root of the thread.

Hub Washer

This is just a plain duralumin or steel washer which can be turned and parted off from a piece of 1 in. diameter bar. When the collet, hub and washer are assembled on the shaft and drawn up by the hub nut, the grip on the shaft should be firm without the necessity for using undue force on the nut.



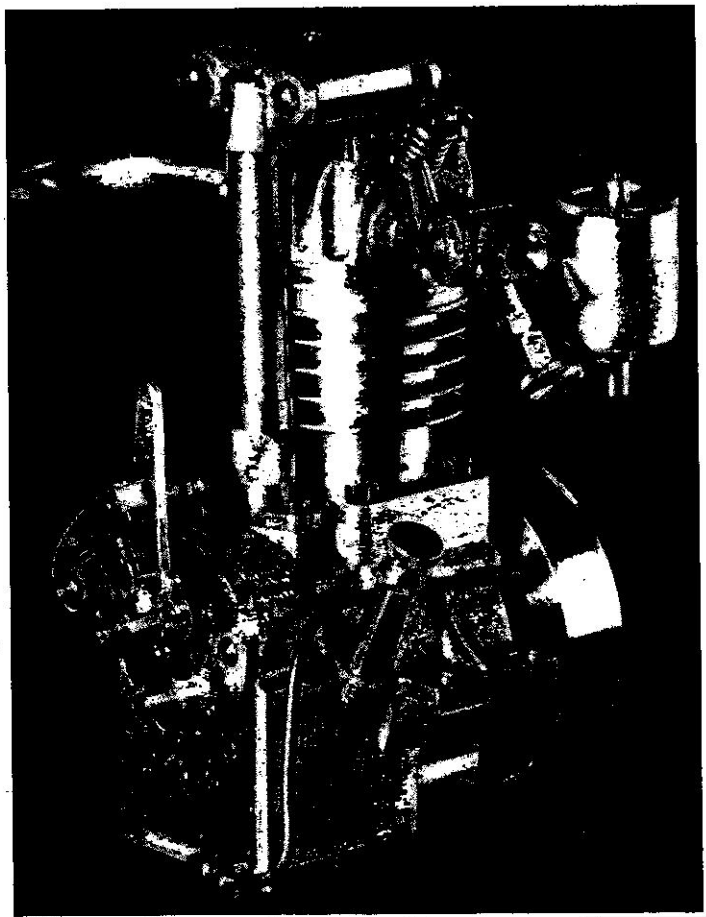
Hub washer

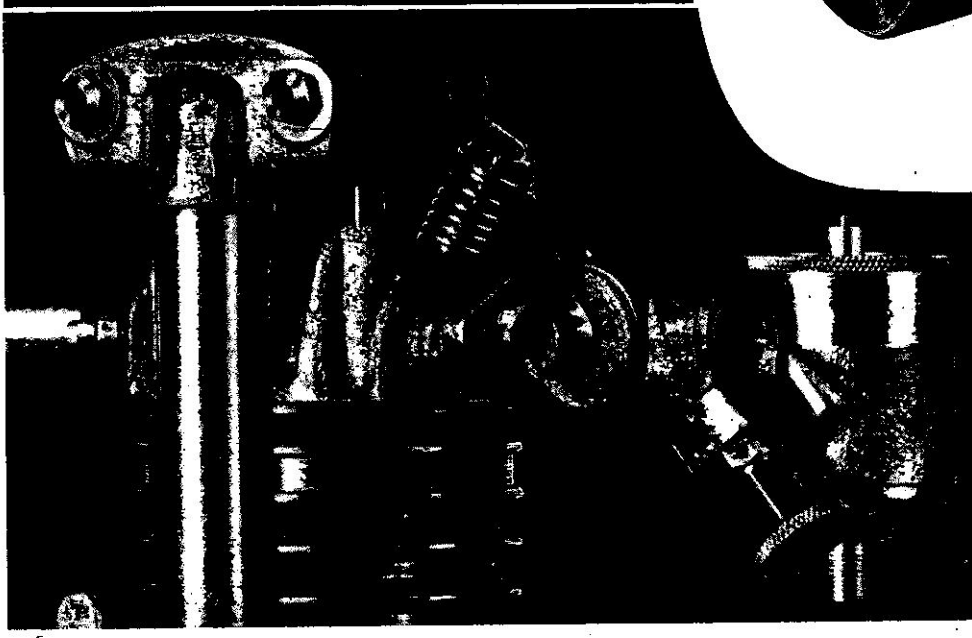
Some engines are equipped with knurled, serrated or studded hub flanges or washers for the purpose of gripping the propeller, but I have found these expedients quite unnecessary, as the grip afforded by plain machined surfaces appears adequate, and avoids the risk of tearing or otherwise damaging the propeller centre. In the case of fitting a flywheel, there may possibly be rather greater tendency to slip, due to increased inertia, but at the worst, I have only found it necessary to interpose a brown paper washer between the hub flange and flywheel boss to ensure sufficiently tight grip. If only a flywheel is to be fitted, its centre may be taper-bored to fit directly on the hub collet, and equipped with a cam to operate the contact-breaker, instead of using a separate hub.

CORRECTION. The cubic capacity of the engine given in the heading on p. 26 of the July 11th issue should read 2.5-c c. not 5-c.c.

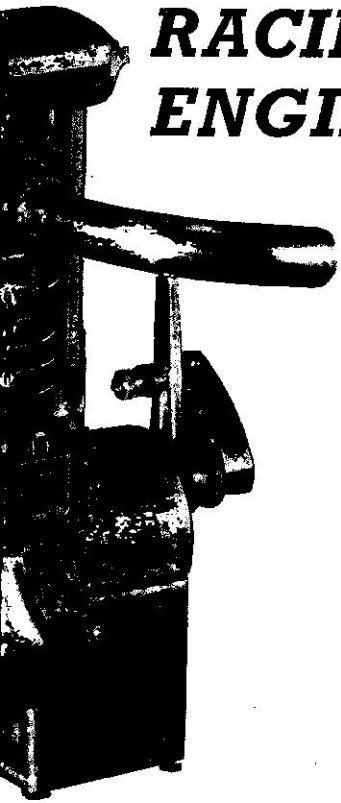
(To be continued)

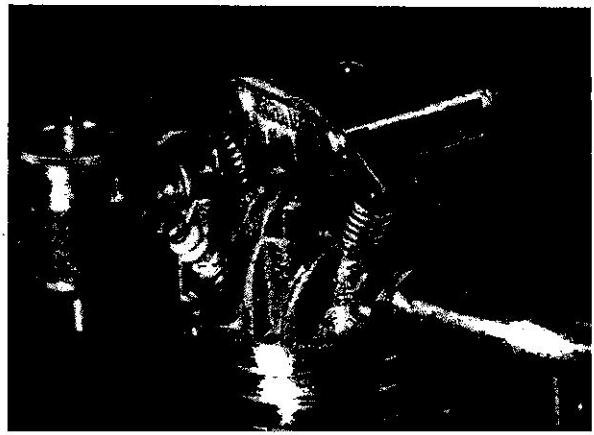
F. H. Miller' 15-c.c. "1





...ITTIWAKE" RACING ENGINE



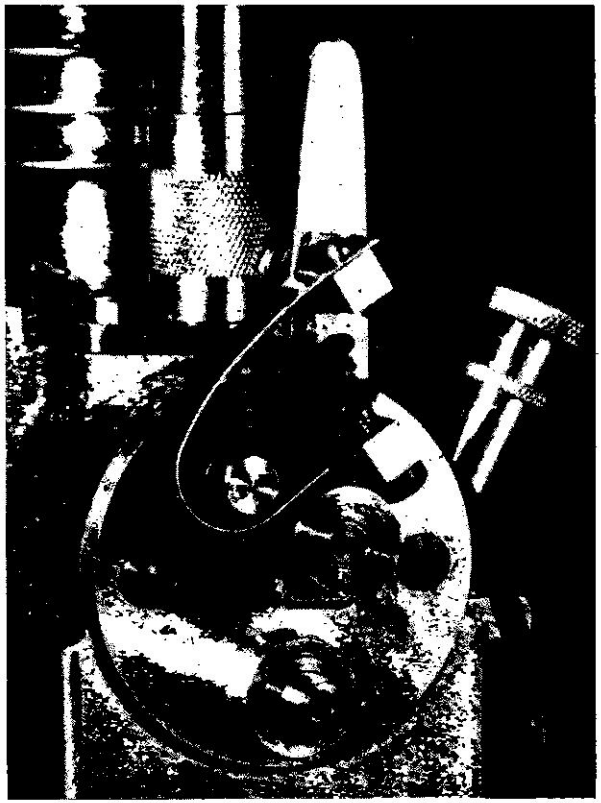


BOTTOM LEFT : A close-up of the rocker box and float-feed, barrel-throttle automatic carburettor.

TOP RIGHT : Cylinder-head, showing inclined valves and sparking-plug.

BOTTOM RIGHT : The contact-breaker, which employs a Lucas low-inertia bakelite rocker arm with tungsten contacts, operated from an external cam on the end of the engine camshaft.

Photographs by W. A. J. Grove.

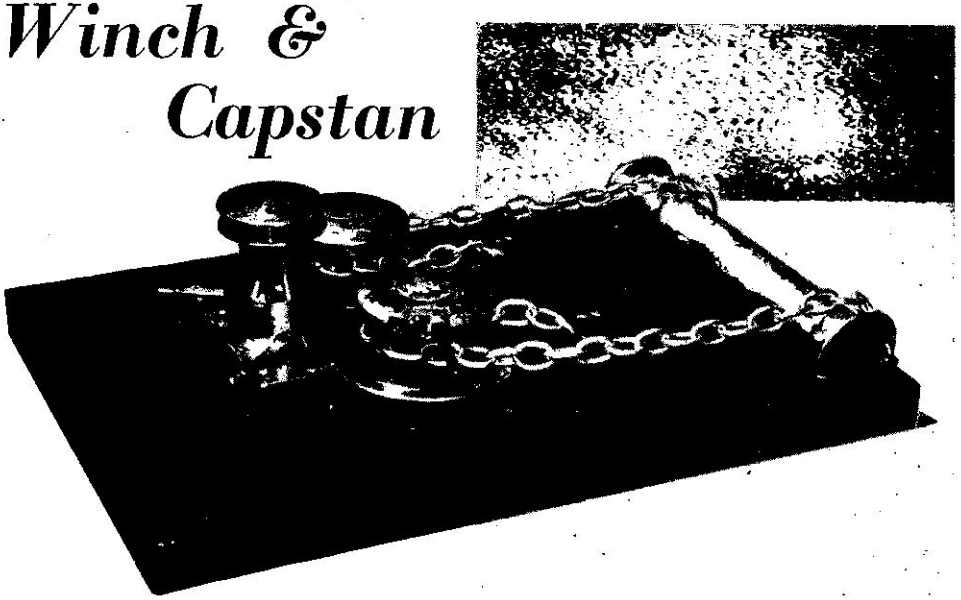


THIS example of Mr. Edgar T. Westbury's popular 15 c.c. overhead-valve engine, constructed by a Welling reader, is an excellent piece of work, and shows that engines of this type give plenty of scope for good workmanship and finish. It may be mentioned that the design embodies the most efficient and up-to-date features of racing engine practice, including a ball-bearing crankshaft, inclined valves with enclosed push-rods and rockers, and forced lubrication on the dry-sump system.

CENTRE : General view of the engine from exhaust side.

TOP LEFT : Inlet side of engine, showing enclosed valve operating gear, and filler tube to oil sump.

Winch & Capstan



by
J. E. Jones

THE photograph shows a model of a combined anchor-winch and capstan, which I hope may prove of interest.

The model came into my possession about twenty-five years ago and is, I think, to scale. The manufacturers were, I believe, Messrs. Harfield & Co. Ltd., Blaydon Iron Works, Blaydon-on-Tyne.

I should think it is probably about forty or fifty years old, though I am not certain of this.

The two levers on the left are for bringing the chain barrels in and out of gear with the capstan barrel. The small handle in the centre enables a ratchet action, either clockwise or anti-clockwise, to be applied to this latter.

The chain barrels are also fitted with friction brakes applied by revolving their top plates. The brake can be brought into action either by the ratchet or by the removable hand lever.

The model is of brass, partly of castings and the rest fabricated. The whole is mounted on a mahogany base.

The chain is made of brass, the links being silver-soldered at the joints. One end of each chain is shown entering what is no doubt intended to represent the chain locker.

The capstan-bar is missing, and if any of your readers could supply me with particulars of this or any other information concerning the model, I should be very grateful.

Electric Railways with no Track Conductor

(*Continued from page* 82)

which the wiper is soldered, the jumper connections at each end of the truck through which the supply is taken to the locomotive, and the wiring, which is self-explanatory. It may be added that the truck has given good service and that when not in use as a battery carrier, the absence of a lot of conspicuous electrical equipment makes it suitable for ordinary goods train working.

Whenever an unorthodox railway model is discussed, the question of a precedent in real practice is often raised ; this invariably solicits the reply that no matter how unusual the arrangement may seem, a prototype embodying the principles can be found to have existed at some time and somewhere on the world's railway systems, and the battery truck certainly substantiates this theory. Two of the " Great Southerns " contribute well-known examples : the Drumm battery rail-motor cars of the G.S.R. of Eire and the " mobile power stations " of the Buenos Aires Great Southern Railway, large steel box-vans, which are coupled to ordinary electric trains and provide them with power from diesel-driven generators when working over routes which are not electrified.

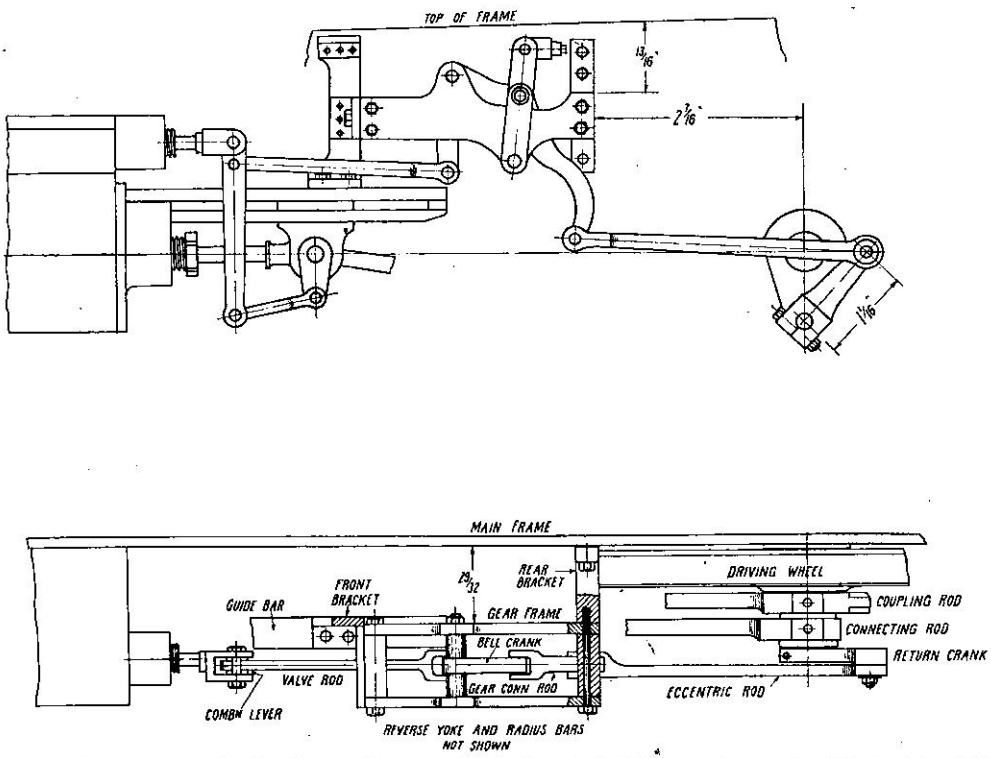
"L.B.S.C"

BAKER VALVE-GEAR FOR "HIELAN' LASSIE"

HERE, as promised, is the how-to-do-it for the Baker valve-gear for "Hielan' Lassie."

As you can see from the illustrations, the layout is simple, and the whole doings easily made and erected. The chief advantage over the Walschaerts gear is that there are no slotted links to make and erect, and no dieblocks to worry about; die slip is eliminated, as there are no dies to slip, and the complete sets of gear are built up in simple frames, off the engine, and then erected by aid of two simple brackets which can be made from bar and sheet metal, no complicated castings being needed. No knee-joint is required for the valve-spindle connection of slide-valve cylinders, and the gear is applicable to either slide- or piston-valve cylinders without any alteration whatever to the gear itself. For slide-valve cylinders, the connections are as shown on the general arrangement given here; for piston-valve cylinders, the return crank follows the main crank instead of leading it, and the valve rod is connected to the top hole in the combination lever, the lever itself being pinned to the valve crosshead through the lower hole.

No separate set of gear will be required to drive the valve of the inside cylinder. Whilst the gear, as I have arranged it, could be erected inside the frames quite easily, and would miss the bottom of the boiler barrel, the trouble would be the drive. The Baker gear needs a much bigger throw of the return crank than a Walschaerts gear, as the bottom of the gear connecting-rod needs to swing from three to four times the required valve travel, according to the amount of movement the reverse yoke can be given between full forward and backward positions. To get the full-gear movement on the "Lassie" the return cranks need to describe a circle 1⅜ in. diameter, which is nearly as much as the swing of the main cranks. That would mean, of course, that we should have to use an eccentric on the crank-axle to give a similar movement; and as this joker would be about the size of the bogie wheels, it is completely out of court. The easiest way, in this case, to drive the inside valve, is to extend the outside valve spindles through the front bosses of the steam-chests, through glands similar to those on the back bosses. The extended spindles carry



General arrangement in elevation and part sectional plan of the Baker valve-gear for "Hielan' Lassie"

plain forks, in which work short links coupled to a simple two-to-one conjugated gear as used on all the Gresley Pacifics. This consists of two levers only, and is erected on a simple bracket across the frames between the inside and outside cylinders. The steam distribution will be all right, as the three cylinders are all in the same plane, and the cranks set at 120 deg. The trouble with the "two-to-one" usually arises when the cylinders are out of line, as on the original engines, and the inside crank has to be arranged to suit the gear; any wear or slight inaccuracy soon upsets the valve setting and causes syncopation in the beats of the exhaust. We shan't have any of those antics. I will deal with the extended spindles and other alterations, all being well, when we come to the job of establishing communications, in a manner of speaking, between the inside and outside cylinders. Meantime, the first job is to make the gear frames and brackets; sufficient for the day is the evil (?) thereof! The frames are of the girder type, of the standard pattern used for full-sized Baker-fitted engines in U.S.A. and elsewhere.

Gear Frames

Although one left-hand and one right-hand gear assembly is needed with the ordinary kinds of valve-gear, both sets of Baker gear are exactly similar. One is erected with its right-hand side nearest the main frames, and the other with its left; so you don't have to stop and consider which bits have to be turned around to be erected properly. Four side-frame plates are needed; these are cut from $\frac{1}{8}$-in. mild-steel plate; any odd bits left over from main frames being just right if of suitable size. The dimensions are given in the drawing. As I have remarked before, I detest odd thirty-seconds, but as the gear has to be properly proportioned to give correct valve movements, the vertical distance between the centres of the upper and lower holes is 31/32 in. Note, whilst all the holes in the lower lugs on the frames are reamed 5/32-in., the holes in the upper lugs are not the same size. Those on the inner sides of the frames, when same are erected, should be drilled $\frac{1}{8}$-in. or No. 30, and those on the outer sides are 5/32 in. The best way to avoid forgetting which side is which, is to drill all the top holes No. 30, and open out the outside ones when the brackets have been made, and the gear frames temporarily erected.

The end-pieces, or spacers, are made from $\frac{1}{2}$-in. by $\frac{1}{4}$-in. bar; it doesn't matter whether steel or brass is used, as there is no movement and no wear. As the ends must be dead-square, to ensure correct alignment of the gear frames all ways, chuck the piece of bar truly in the four-jaw, and part off four lengths a tiny shade over $\frac{3}{4}$ in. long. To ensure that they are all alike, beginners should part off to about 1/32 in. over length, then chuck each separately, and face the ends, so that when cheeked with slide gauge or calipers, each piece fits exactly between the jaws. Personally, I've got so used to counting the turns (involuntarily) of the top-slide handle when running the parting-tool along for cutting off, that I seldom have need to use any measuring instrument at all. Drill the four No. 41 screw-holes in one of the gear frames, and use that as a jig to drill the others; the holes are $\frac{1}{8}$ in. from the ends, and $\frac{1}{8}$ in. from top and bottom, the exact positions being of no moment as long as all four frames are drilled alike. Now assemble a pair of frames with a spacer at each end, holding the lot together with a toolmaker's cramp, and poke the 41-drill in each ditto hole in the frames, making countersinks on the ends of the spacers. Mark which end is which, and which is top and bottom of each spacer; then take them apart. Drill the holes in the front spacer No. 48, and tap them 3/32-in. or 7-B.A. Drill the holes in the back one No. 41, and take them clean through; the best way is to drill about halfway through from one side, using either drilling machine or lathe, then turn the piece end for end, and drill again until the drill breaks through into the first half of the holes. Be careful with your feed as it does break through, or you'll have a break of another kind, to remedy which will cause a slight fluctuation in the firm's finances, and probably add a word or two to the Dictionary of Railroad Esperanto. The frames can then be temporarily erected, using any odd suitable screws at the front end (one each side will do) and a bit of screwed wire with a nut on each end at the back, just to hold them together.

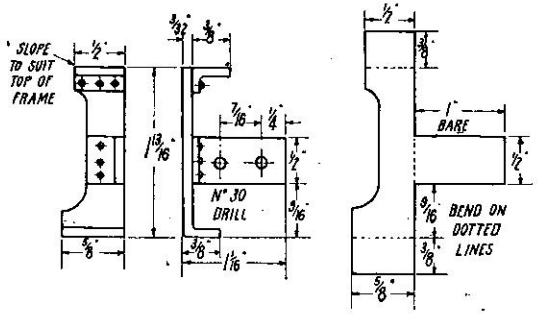
The spindles for the bell-cranks can now be made and fitted. These are simple enough, being merely pieces of 5/32-in. round silver-steel a full $1\frac{1}{8}$ in. long. Chuck each one truly in the three-jaw, and turn down a full $\frac{1}{4}$ in. of one end to $\frac{1}{8}$ in. diameter, screwing either $\frac{1}{8}$ in. or 5-B.A. Open out the hole in the outer frame plate to 5/32 in.; push the spindle through, so that the screwed end goes through the $\frac{1}{8}$-in. hole in the inner plate, and secure with an ordinary commercial nut.

Front Bracket

The front bracket can be cut from a piece of 3/32-in. mild-steel sheet, and have the angles riveted on; or if you are good at what my young niece in her schoolgirl days called "bendification," it may be cut out and bent to shape. For the former process, you need a bit of $\frac{5}{8}$-in. by 3/32-in. steel strip $2\frac{3}{16}$ in. long. File to shape, as shown; note, the top isn't exactly square with the straight side, but slopes at a very weeny angle (actually 1 deg.) to be parallel with the top of the main frame. It forms a support for the running-board, and is itself supported by same—a kind of column of mutual support! At the upper end, rivet a bit of angle; you can bend this up from any suitable scrap of sheet steel about 13-gauge, the upper part being $\frac{3}{8}$ in. wide. The lower end is bent over at right-angles for $\frac{3}{8}$ in. to form the lug which is screwed to the top of the guide-bar. The angle for attachment of the gear frame is bent up from $\frac{1}{2}$-in. by 3/32-in. steel strip, and is riveted to the bracket at $\frac{9}{16}$ in. from the bottom; see small detail illustration for shape, sizes and assembly. Don't forget that you'll need one of these brackets right-handed and one left-handed.

To make a one-piece bent-up bracket, a piece of soft ductile sheet steel of 13-gauge is required. Mark out as shown in the alternative sketch, then carefully bend on the dotted lines. The same marking-out does for both right- and left-hand brackets; simply bend one lot of "tags" toward you, and the other away from you, and the trick is done. Yet another way would be to bend the

top and bottom angles, and attach the side one separately by using an oxy-acetylene blowpipe and a touch of Sifbronze, which would form a fillet in the angle, and add to the strength of the bracket. In that case, I should make the angle channel-shaped. Old Curly is fond of his blowpipe; "Jeanie Deans" isn't half a fabricated box of



Front bracket

tricks! Drill two No. 30 holes in the side angle as shown; place the bracket against the end of the gear frame, the side angle being in line all ways with the spacer, hold in position with a toolmaker's cramp, and drill and tap the holes in the spacer, using those in the angle as guide, for two $\frac{1}{8}$-in. or 5-B.A. screws; see elevation of complete assembly. Two No. 30 holes can be drilled in the foot of the bracket, for attachment to the guide-bar when the whole gear is finally erected.

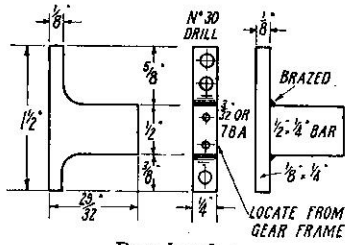
Rear Bracket

This is very simple, and may be made from a casting, built up, or cut from solid, just as you please. Here again, I am compelled to use one of those detested thirty-second measurements, in order to have the gear frame at the correct distance from the main frame, to keep the gear in a straight line. If a casting is used, it will only need cleaning up and drilling; but in order to ensure the back and face being parallel, it would be advisable to chuck it in the four-jaw and face the back (says Pat); drill the screw holes, and screw it to a truly-faced bit of wood or metal, which in turn is attached to the faceplate. The contact face for attaching to the gear frame can then be machined off to the exact dimension required, viz.: 29/32 in., and it will be parallel with the back. If a milling machine is available, or a planer or shaper, the job is, of course, just a cakewalk.

The complete bracket could be cut from a $1\frac{1}{2}$-in. length of 1-in. by $\frac{1}{2}$-in. bar, the unwanted portions being sawn away and the piece finished to shape with a file. The holes should be drilled, and the contact face machined-off as described above. The bracket is also built up very easily; the back is formed from a piece of $\frac{1}{8}$-in. by $\frac{1}{2}$-in. rod (steel or brass will do) $1\frac{1}{2}$ in. long. The projection for attachment to the gear frame is a piece of $\frac{1}{2}$-in. by $\frac{1}{4}$-in. bar, parted-off in the four-jaw to a dead length of 25/32 in., and brazed or silver-soldered to the back part in the position shown in the illustration. No further machining of either back or contact face would be necessary.

Erection

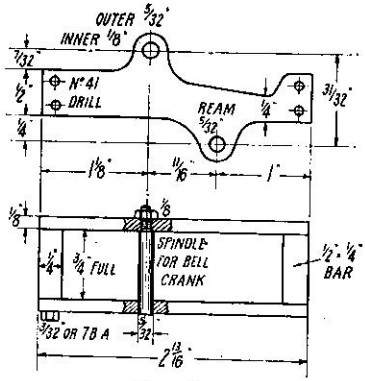
Put the rear bracket against the rear end of the gear frame, the temporary bolt being removed, and hold it in position with a toolmaker's cramp. Poke the No. 41 drill right through spacer and both frames, making countersinks on contact face of bracket, then remove cramp, drill the counter-



Rear bracket

sinks No. 48, and tap 3/32-in. or 7-B.A. The frame is secured to the bracket by two bolts made from pieces of 3/32-in. silver-steel about $1\frac{1}{2}$ in. long, with $\frac{1}{2}$ in. of thread on one end, and just enough to take a nut on the other; see plan view of assembled gear.

Now put the gear frame in place, as shown in the elevation; the top of the rear end of the gear frame should be $\frac{13}{16}$ in. from the top of the main frame, and $2\frac{7}{16}$ in. ahead of the centre of the driving axle. The foot of the front bracket should rest on the top of the guide-bar. Poke the drill through holes in bracket and foot, make countersinks on frame and guide-bar, then drill No. 40 and tap for $\frac{1}{8}$-in. or 5-B.A. screws. You



Gear frame

can drill the frame No. 30, and use bolts if you so desire; bolts are used on full-sized engines. File off any portions of screw projecting below the guide-bar, so that they won't be able to foul the crosshead. That settles the gear frames and their erection; the next job will be to make the rods and levers, and put them in the frames, which is easier than making curved slotted links.

Eureka! or Patience Rewarded

On the showery afternoon of June 15th a weeny-weeny bit of locomotive history was made on my little railway. I don't suppose it will ever be recorded in the annals of full-sized locomotive history, but nevertheless it settled, for once and all, exactly what the "something" was that prevented Francis Webb's compound engines from being the success that they deserved to be. "Bro. Francis of Crewe" was a clever and far-sighted locomotive engineer, but he suffered from two drawbacks, handicaps, or whatever you or the Oxford Dictionary like to call them. The first was that he had very little data to go upon, and had to find out everything by trial and error. That wasn't his fault, but his misfortune; the second *was* his fault, inasmuch as he would not consider any suggestion from anybody else!

I never had a trip on a Webb compound engine (though I had one on a "Jumbo," as related in one of my reminiscences), but I spent many hours on the platform at Willesden and elsewhere, in days now far back in the dim and distant past. Always eagerly searching for information, and ever anxious to learn, I talked with many L.N.W.R. drivers, and obtained much useful first-hand information on the way the compounds behaved in service. I also travelled in the trains, was amused by the "see-saw" motion which persisted until the train had accelerated to about 25 m.p.h., and noticed that, like our radial tanks, they went "so fast and no faster." It was evident that "something" was wrong with them, but what that "something" was, nobody seemed to be able to say with absolute certainty; anyway, the Webb system has been the subject of debate and argument, on and off, as one might say, ever since *Experiment* herself took the road back in 1882.

Your humble servant knew the construction of the various engines from A to Z; and in the weary nights spent in the shelter during the 1940 blitz and the ensuing years of misery, I often tried to forget the conditions of modern civilisation by puzzling out locomotive problems; and remembering all the drivers had told me, I pieced the bits together and got what I thought was the reason for the comparative failure of the Webb compounds. Webb's *idea* was O.K.; it was in the application of it, and the way the engines were arranged, that the fault lay. I decided that if I survived the last "all clear," I would build a little "Jeanie Deans" (my favourite Webb engine) and see if I was right. Well, thanks to a kindly Providence, I did survive; I have now built the engine as far as the running stage—and I *was* right!

Little "Jeanie" is 3½-in. gauge, and in all her essentials she is a one-sixteenth edition of her big sister—boiler, cylinders, wheels, wheelbase and so on. The leading wheels are 3 in. diameter, drivers 5½ in., high-pressure cylinders ⅞ in. by 1½ in., with Joy valve-gear upside down, low-pressure cylinder 1⅞ in. by 1½ in., with a loose eccentric, same as big sister. Externally, the boiler is exactly "to scale," with a barrel 3½ in. diameter, and a firebox fitting between the two independent driving axles. Internally, the boiler is *smaller* than "scale," as I set the tubeplate ¾ in. back into the barrel, to obtain sufficient room in the smokebox for my pipe connections. The chief difference in the layout is that the low-pressure steam-chest is at the side of cylinder instead of on top—I needed the space under the smokebox for my intercepting valve—which not only gives a direct exhaust, but saves fitting a rocking-shaft for the valve drive. All valves have the equivalent of 6½ in. travel, with my pet setting (plenty of lead included) and the low-pressure valve cuts off at 60 per cent. There is a low-reading steam gauge on the footplate, connected to the low-pressure steam-chest. The engine is superheated, has a twin-pump mechanical lubricator (one for high pressure and one for low pressure in the same tank) and boiler feed is by injector only.

On the afternoon mentioned, she got up steam in three minutes, and as soon as the condensate water had blown out of all the cylinder cocks—there is a warming pipe for the big low-pressure cylinder—I let her run a few turns with the intercepting valve open; then shut it, also the cocks, took my seat on the car, opened the regulator, and then baby "Jeanie" promptly proceeded to do everything her big sister didn't. Off she went, no hesitation, no "see-sawing," acceleration like "Milly Amp," and I had to notch up mighty quick and ease the regulator, to prevent her running off the road. At 35 per cent. cut-off in the H.P. cylinders and only 15 lb. showing on the low-pressure gauge, she flew around the line at a "scale 90," with the firehole door open a bit and 85 lb. on the boiler gauge; the blast was inaudible, which is hardly to be wondered at, as the steam in the L.P. cylinder was about down to atmospheric pressure by the time it expanded. The rain started again, but I let her burn the fire out. She covered just over a mile on the one firing. Yes, Francis W. Webb was a clever engineer!

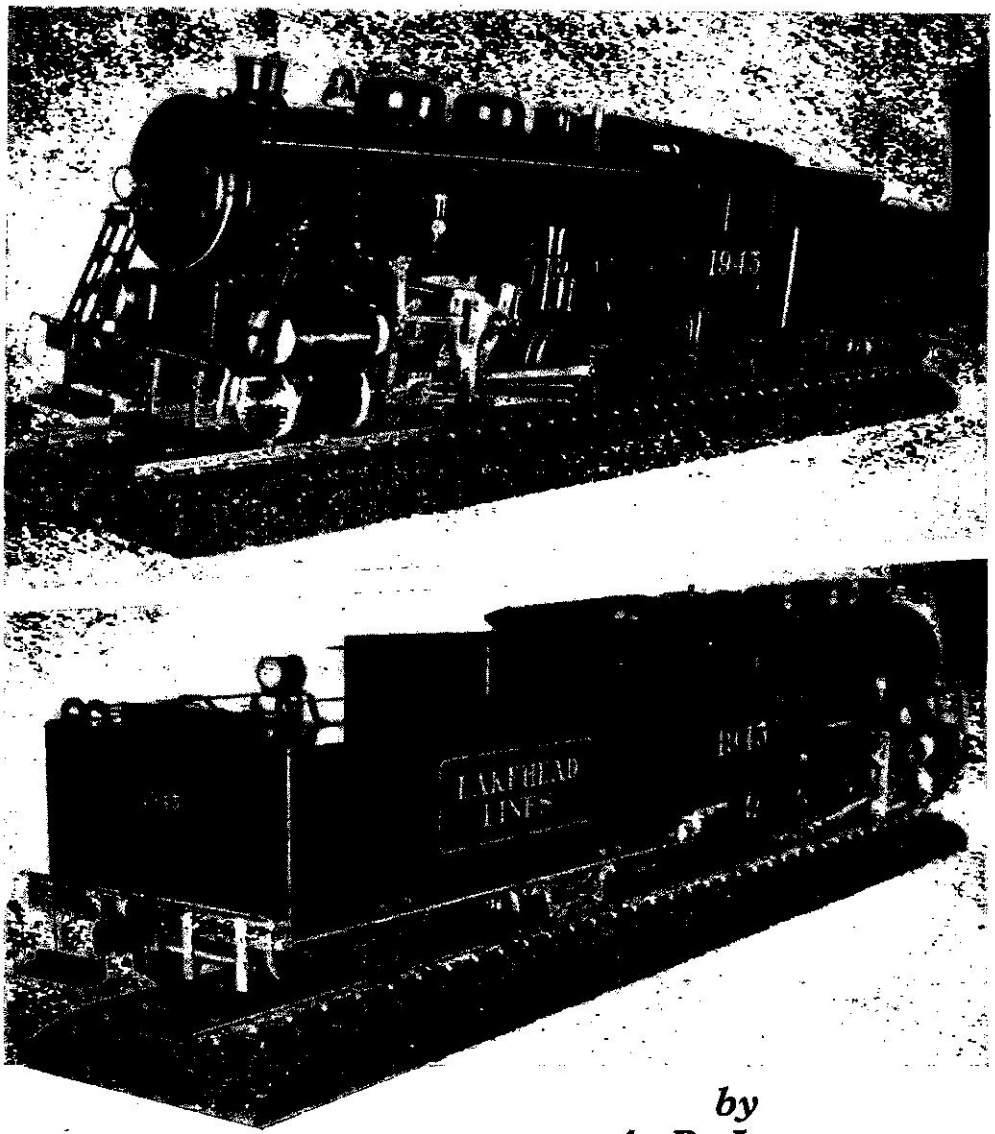
For the Bookshelf

Improving London's Transport. (London: *The Railway Gazette*, 33, Tothill Street, S.W.1.) Price 5s. net. 108 pages, size 9 in. by 12 in.

In 1935 work was put in hand upon an elaborate scheme of improvements and extensions to the London Passenger Transport Board's railway communications in and around the Metropolis. Owing to war breaking out in September, 1939, this work was brought to a standstill, with much remaining to be done. A partial resumption has been effected during recent months, though some years must yet elapse before the whole scheme can be completed.

The book under review contains a fairly fully detailed and copiously illustrated description of the work so far as it has progressed to date. The illustrations comprise maps, diagrams, drawings and photographs, which, taken as a whole, give a clear impression of the magnitude of the undertaking; practically every phase of the scheme receives its due share of attention. For the first time, so far as we are aware, drawings of the latest L.P.T.B. rolling-stock become available, and we feel that these will make a particular appeal to those of our readers who are interested in electric railway vehicles.

Canadian Switcher



by
A. B. Jaques

MY first attempt at small locomotive building was an "O"-gauge edition of "Maisie," described by "L.B.S.C." in the back issues of THE MODEL ENGINEER.

Back in 1935, having acquired an elevation print of the 0-6-0 Canadian switcher (one of which was built by Mr. Dawson and described some time ago in THE MODEL ENGINEER), I began by making the wheel and cylinder patterns and also made a start on the frames, which were of ½-in. tool steel. Due to pressure of other matters, no further work was done on the engine until the winter of 1943, at which time a fresh start was made, but under very different circumstances.

I had at first begun building the engine at home in my own small workshop, but this time I, having an official position in a local engineering works engaged in war work, was given permission

to use any of the machines in the shop which were not in use in the evenings.

A 16-in. lathe was used for all the lathe work, and the wheels, axles, etc., were turned up, frames milled on a vertical miller and then ground on a surface-grinder, as was all the flat work, the only flat steel available being that called plate.

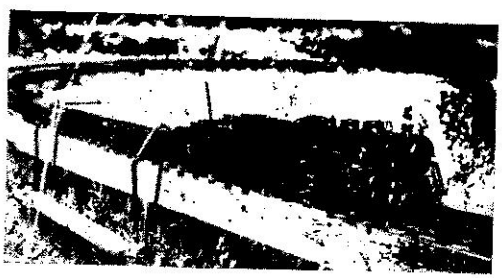
The cylinders are of bronze in two pieces, as in Canadian practice; the bolting-faces were machined and the two halves bolted together. They were then set up in a vertical-miller of the jig-borer type, and cylinder bores and valve bores faced, and radius for smokebox machined, all in the one setting. Bronze valve liners were pressed in, and stainless-steel was used for the piston-valves. The piston-valve liners were honed on a honing machine.

The piston-valves are just plain bobbins and were turned on the lathe a tight push-fit in the liner bores; they were then worked back and forth, using plenty of oil, until they became free; they were then tested on 100 lb. of air pressure and showed no sign of leaking and the engine will haul four adults on 30 lb. of steam. In my opinion, the trouble most of us have in making piston-valves in these small sizes is not in making the valves themselves, but in making the bores perfectly round and straight; boring and reaming the liners is not good enough, and they should be lapped or honed.

The valve gear is Walschaerts, and all parts are bronze-bushed; the reverse is by screw and nut located inside the dummy air reverse cylinder.

Difficulty in obtaining suitable copper tubing for the boiler was encountered, the only thing obtainable being 3½-in. o.d. extra-heavy copper pipe which had a $\frac{5}{16}$-in. wall; so this was bored out until it had a 3/32-in. wall. $\frac{1}{16}$-in. sheet was used for the combustion chamber, backhead throat-sheet, etc. Ten $\frac{3}{8}$-in. flue-tubes and two $\frac{5}{8}$-in. superheater tubes were used, the whole lot stuck together with Sil-Fast by the aid of an oxy-acetylene torch, then tested to 200 lb. cold-water pressure.

A disc-in-tube front-end throttle was put in; it is controlled from the cab *via* the boiler hand-rails. Superheated steam is taken through one of the hollow stays to the header in the cab and connected to blower steam-gauge, whistle, etc.



The boiler was lagged with 3/32-in. asbestos sheet and then 0.0003-in. sheet brass, which was cut and fitted; small pieces of brass were soldered on the inside and tapped to receive the handrail supports; the asbestos was cut out to receive the pieces of brass. The lagging was then removed and sprayed with one coat of primer-surface and then followed with two coats of black lacquer, which leaves a matt finish, which is desirable on this type of model; the smokebox was finished with smokebox paint obtained from the local railway shops.

The method of making the number-plate on the smokebox might be of interest as it makes a professional-looking job and is easy to do. A number of the correct size and style was cut out of an old calendar and glued to a piece of shim brass, holes were drilled where possible through the paper and brass to remove some of the metal around the numbers; they were then cut and filed as close as possible to the paper numbers. A small piece of brass was recessed with a small end-mill and the numbers were sweated on in the proper positions; the face was then given a coat of black lacquer and, when dry, rubbed on fine emery, which left a black background with the raised brass numbers.

The engine is fitted with an axle-driven feed pump, hand pump in tender, "L.B.S.C." mechanical lubricator, steam-gauge, water-gauge, whistle, cylinder drain-cocks, etc. The tender trucks are fully sprung. The lettering was done in gold leaf by a kind friend.

Specifications

0-6-0 switcher, 2½-in. gauge, 1-in. bore, 1¼-in. stroke; driving wheels, 2 $\frac{5}{16}$ in. diameter; piston-valves, $\frac{9}{16}$ in. diameter; valve travel, $\frac{7}{16}$ in. Boiler, 3½ in. diameter; ten fire-tubes; two superheater tubes; combustion-chamber; grate area, 16 sq. in.; coal fired. Valve-gear, Walschaerts.

The engine was running for three evenings at a local carnival, where we had 125 ft. of continuous track; later, I took it to Winnipeg on my holidays, where the local Live Steam Club have 618 ft. of continuous track. Here the engine was given a real try-out, often running for six hours a day; the maximum speed was 9 m.p.h. with one passenger.

"Live Steam" in Somerset

WE hear that safety-valves are blowing off in Somerset and that live steam enthusiasts are clamouring for a club and for a communal track. In the Yeovil district at least a dozen locomotives are either completed or on the point of emerging from the shops. Locomotive owners, and other model engineers, within reach are asked to get in touch with Mr. Harold C. Tilzey, 43, Princes Street, Yeovil, so that a get-together meeting can be arranged.

ROTATING CENTRES FOR SMALL LATHES

By H. R. HADLOW

IT has always been a source of wonder to me that model engineers do not make greater use of rotating centres in lathe work, as their advantages are many. The use of the normal stationary tailstock centre requires careful adjustment and lubrication if it is to perform its function properly, and when once adjusted requires careful watching to ensure that no undue friction between it and the workpiece develops, as this would cause considerable heating. The result of this heating has far-reaching effects if allowed to pass unobserved or uncorrected.

It may distort work of small diameters ; in the case of some metals "work-hardening" may occur, either locally or throughout the length of the work ; inaccurate machining results, due to the expansion of the workpiece being greater at the tailstock end, which when cool may be found several thous. undersize when compared with the opposite end.

In addition to these effects on the work itself, damage is caused to the centre, even though it is (or should be) dead hard. The point softens and therefore wears much more quickly than is good for accurate work, and scouring takes place. Such a centre is practically useless until reground and hardened, or replaced !

The main point in favour of the stationary centre is that, in theory at least, it is possible to remove and replace it countless times without any qualms regarding its accuracy, provided the normal precautions are taken to ensure that the tapers on centre and tailstock barrel are clean. These remarks also apply to the commercially-made revolving centre, as all parts are hardened and ground, and wear is almost non-existent.

In the case of the amateur-made article, however, few of us possess the facilities for hardening and grinding to fine limits, and other, less certain, methods of obtaining accuracy (and maintaining it) have to be adopted. I have found the methods described below to give every satisfaction over a number of years, provided, of course, that every care is taken in the initial machining of the parts. The particular design has the advantage over some commercial types, in that it is possible to replace the centre with a new one very quickly, and also enables hollow or pipe centres to be used in the same body.

Simplicity has been aimed at, hence the use of a single ball, instead of the more usual thrust race, which would involve the use of a larger body to accommodate the race, and the centre proper would have to have a shoulder machined on it. For those who would prefer the normal type of ball-thrust race, the design can be easily adapted, but for use on lathes of from 3-in. to 4-in. capacity the design as given can be relied on.

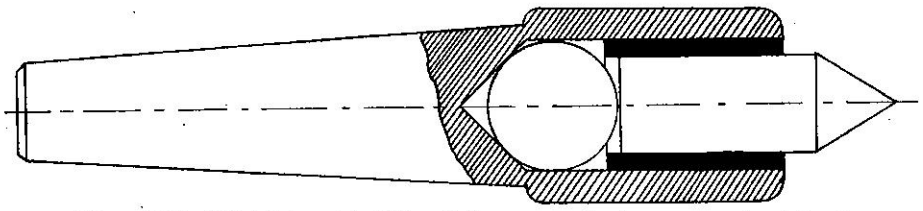


Fig. 1. Part-sectional drawing of the rotating centre, showing constructional details

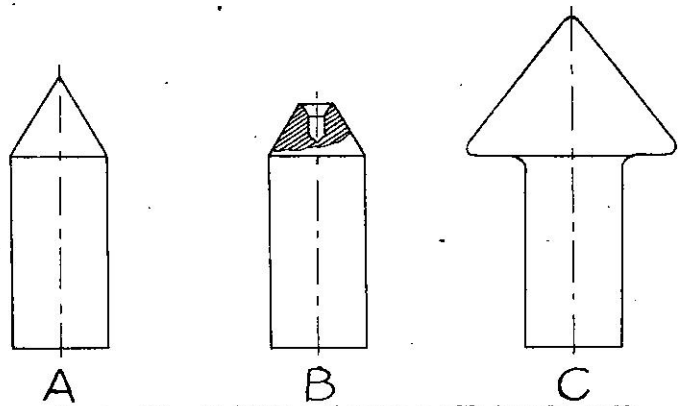


Fig. 2. Three useful types of centres, readily interchangeable

The fact that the centre itself can slip out of the body may be considered a disadvantage by some, but I have found the reverse to be the case. But here again, the design can be modified if desired, and a retaining screw fitted in the body to engage with a groove turned on the stem of the centre. It will be noted that though the centre can slip out, the ball cannot, as the bronze bush keeps it in its proper place ; and an oil reservoir is formed by the same bush. (Fig. 1.)

Regarding construction, the body is of mild steel or nickel-chrome steel (from the ubiquitous car axle), the latter being the better of the two, as its greater toughness will mean less wear on the taper shank. The blank for the body is chucked in the three-jaw and machined down to the diameter of the straight portion, and then the top-slide is set to the correct angle (to suit the particular taper used) and the taper is turned. The truth—or otherwise—of the taper can be tested by marking the shank with blue and running up the actual tailstock as a gauge. When a perfect fit has been obtained, part-off the body, remove the chuck, and carry out the rest of the machining with the job held by the headstock-spindle taper. This method ensures almost automatic accuracy.

The bush is the next item, and needs no detailing, except to say that the usual method of machining the bore and then mounting on a stub mandrel for finishing the outside, should be used. Use a good quality phosphor-bronze if possible, in preference to gunmetal. After inserting the steel ball, the bush may be pressed in and reamed.

The best way of machining the centres proper is to turn up a bit of scrap steel rod a really good fit for the bush, and use this as a gauge. The centres can then be turned in one setting, the stem first, and then the point, which again ensures utmost accuracy. Nickel-chrome steel is used for the centres, and a good finish should be aimed for. The taper point (60 deg.) should not give any trouble, though if you have a bevel protractor it is a good thing to check the accuracy of the lathe index.

Fig. 2 shows three types of centre, all extremely useful in their different spheres. (A) is the ordinary 60-deg. pointed centre ; (B) is a hollow centre, easily produced by first turning a flat end on type (A) and then carefully drilling with suitable sized drills and countersinking ; (C) is a conical centre for tube work, and can be made to any necessary size.

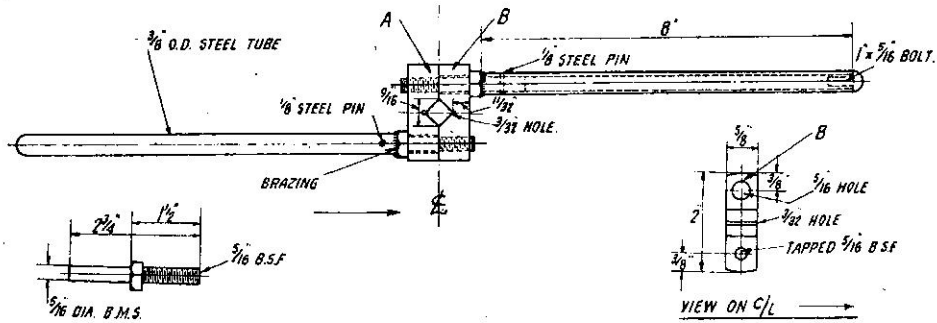
No dimensions are given on the drawings, as these will depend on the taper used on the lathe for which the centre is being made. But the proportions shown are correct and taken from my own specimen, which is for No. 2 Morse taper.

A QUALITY TAP-WRENCH

WHEN buying or making tools, I always prefer those that handle well and feel "right." The tap-wrench described herein has these attributes. It is a pleasure to use, well balanced and light. Hollow handles are responsible for these good features.

The holding-pieces "A and B" (see sketch) are 2 in. × $\frac{5}{8}$ in. square, b.m.s. They were squared-up and clamped together one on top of the other. Two 17/64-in. holes, each $\frac{3}{8}$ in. from the ends and on the centre-line, were made through both pieces. The hole in each piece but at opposite ends was opened up to $\frac{5}{16}$-in. drilled where indicated and vee sections cut and filed away. The ends were slightly radiused, sharp edges removed, two old bolts screwed into the threads to keep them soft and the pieces case-hardened.

Now the handles. They are of $\frac{3}{8}$-in. o.d., $\frac{5}{16}$-in. i.d. solid-drawn steel tube 8 in. long (each handle.) Two lengths of $\frac{5}{16}$-in. diameter b.m.s. rod, $2\frac{3}{4}$ in. long, were screwed a distance of $1\frac{1}{2}$ in. A $\frac{5}{16}$-in. b.s.f. hexagon nut was threaded on to each and screwed tight. The rod was pushed into each tube, $\frac{1}{8}$-in. diameter holes drilled through tubes and rods held steel



These served as guides to keep the $\frac{5}{16}$-in. b.s.f. taps true when threads were cut in the appropriate holes (see sketch). Two bolts were used to keep the pieces together for the next operation and the clamps removed.

Referring to the sketch ; 3/32-in. holes were pins riveted smoothly into countersinks in the tubes. Brazing completed a strong fixture. Two 1-in. × $\frac{5}{16}$-in. bolts had their heads rounded off and were then jammed into the open ends of the handles. The tool was finished, filed, and emery clothed.—A. F. WARR.

Clubs

Cardiff and District Society of Model and Experimental Engineers

At our meeting on June 19th, we held a successful "Brains Trust" feature, the Brains consisting of Messrs. F. W. Jones, P. Rowe, and F. B. Angwin, while our Vice-Chairman, Mr. Conibeer, took the part of Question Master.

A "Quiz" was held on July 17th, on the lines of "Lucky Dip," in which the questions asked were, naturally, on subjects concerning "Model Engineering in General."

Hon. Secretary: F. B. ANGWIN, 47, Romilly Crescent, Cardiff.

A Proposed Stockport Club

It is proposed to start a new Society which will embrace Stockport, Heaton Mersey, Heaton Moor, Heaton Chapel, and East Didsbury. All lone hands (and there are plenty of them), and those interested should get in touch with either: H. E. CLOW, 107, Lane End Road, Heaton Mersey, Stockport, Cheshire; or F. HEALEY, 13, Ash Grove, Heaton Chapel, Stockport.

The Tyneside Society of Model and Experimental Engineers

Our programme for August is: Saturday, 17th, visit to Throckley Horticultural Show. Transport will be provided to and from the above show for all models. Members are asked to leave models at the Society's Workshop, Manors Station. Wednesday, 28th, 7.30 p.m., at the Workshop, a talk entitled "Standing at the Corner." The Workshop is open on Tuesday, Thursday, Saturday evenings; visitors welcome.

Hon. Secretary: S. G. JONES, 56, Moor Crescent, Gosforth, Newcastle-upon-Tyne.

The Blackheath Model Power Boat Club

We are holding our 1946 Regatta under M.P.B.A. Rules on Sunday, August 11th, at the Princess of Wales Pond, Blackheath, commencing at 11.30 a.m. Members of Clubs affiliated to the M.P.B.A. will be welcomed.

The following are the events to be run:—*Nomination Race*, 50 yds. Two runs will be allowed. 300 *yds. Race for "B" Class Boats* (15 c.c.). *Steering Competition.* 600 *yds. Race for "A" Class Boats* (30 c.c.).

Pole-racing boats will be allowed two runs and two starts for each run. In addition there will be a nomination prize for racing boats.

Travel Information. Nearest Station—Blackheath (Southern Electric). Buses 108, 75, and 89 pass the pond.

Hon. Secretary: J. H. BENSON, 70, Broadfield Road, Catford, S.E.6.

Wellingborough and District Society of Model Engineers

The club was formed in April of this year, and now has a membership of 35. Our headquarters are at the rear of the Queen's Head Hotel, Broad Green, Wellingborough, and a workshop at this address is rapidly being fitted up and will be in operation by the autumn.

General meetings are held at headquarters, at 7.30 p.m., on alternate Fridays, the next meeting being on Friday, July 26th.

Interesting talks and demonstrations are being arranged, and an outing to THE MODEL ENGINEER Exhibition has been arranged for Saturday, August 24th, and Thursday, August 29th.

The Society embraces a general model engineering section, model boat section, and model aircraft section, and anyone, young or old, is cordially invited to our meetings.

Hon. Secretary, J. RYECROFT, 30, Oxford Street, Wellingborough, will be pleased to give any details to interested persons.

National Model Railroad Association (British Region)

The 1946 membership list is now closed, and no more applications can be considered. 1946 members who have failed to renew their membership must now wait until 1947. The Secretary of the British Region, W. F. BOLTON, of 45, Framfield Road, London, W.7, will be pleased to enrol new members for the year beginning January 1st, 1947.

Northampton Amateur Model Engineering Society

Since its inception in October last, this society continues to flourish with a gradually increasing membership. In addition to regular meetings, visits to the Kettering Motive Power Depot, L.M.S.R., and the Express Lift Co. Ltd., Northampton, have recently been made. A permanent clubroom has now been obtained at the Bull and Butcher Hotel, Bridge Street, Northampton, and meetings are now held every Tuesday evening. An attractive programme is being arranged for the coming winter, and all keen model makers in the district are cordially invited to our meetings. Will members please note that a visit to THE MODEL ENGINEER Exhibition has been fixed for August 24th?

Hon. Secretary: E. G. ANSLOW, 16, Weston Way, Northampton.

Oldham Society of Model Engineers

Our meetings will now take place on the second and fourth Fridays in each month, the next being on July 26th, when we shall hold a Jumble Sale. Meetings commence at 7.30 p.m. in the Co-operative Educational Building, Foundry Street, Oldham.

Hon. Secretary: W. K. BUCKLEY, 87, Lyme Terrace, Highfield, Mossley, Lancs.

NOTICES

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The Editor invites correspondence and original contributions on all small power engineering and electrical subjects, which should be addressed to him at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to THE SALES MANAGER, Percival Marshall and Co. Ltd., 23, Great Queen Street, London, W.C.2.

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SALES and WANTS

Private: **Threepence** *word.* *Trade* **Sixpence** *word.* *Use of Box* **2/6** *extra.* *Minimum charge.* **3/-.**

TOOLS & WORKSHOP

Buck and Ryan's Department for Lathes, Drilling Machines, Grinders, Electric Tools, Chucks, Surface Plates, Lathe Accessories and Tools.—310-312, Euston Road, London, N.W.1. Telephone: EUSton 4661. Hours of Business: 8.30 to 5.0 p.m., Monday to Friday; Saturday, 1.0 p.m.

Split Chucks for Watchmakers' 7athes, 6 mm., 6½ mm., and 8 mm., at 6s. each, postage 6d.—JOHN MORRIS, 4, Clerkenwell Road, London, E.C.1.

"Tool News" keeps you up-to-date. Specimen copy 6d., post free.—GARNERS, Sheffield Road, Barnsley.

Wood Workers, Send S.A.E. for details of our new W.T. Lathe.—GARNERS, Sheffield Road, Barnsley.

Copper Tube, ⅛", 5/32", 3/16", to ¾", 2", 2¼", 3", 3⅜", 3½", 4", 4½", 5", 6", 6½", 6¾", 7" O.D., solid drawn; Silver Solder, 2s. 6d. stick; Flux, 2s. and 4s. tin; Rivets, Brazing, Blowlamps, 5 pint, 85s.; six pint, with flexible extension pipe, £6 5s. cash, or C.O.D.—CORBETT'S (LATHES), Stanton Hill, Mansfield. Tel. 583.

B. Draper & Son, 1, Grange Road, Kingston-on-Thames, have a good selection of used Machine Tools, including Bench Lathes, Motorised Drilling Machines, Shapers, Grinders, Millers, etc., also large stocks of new Machine Tools and Small Tools. Send for detailed list or call and inspect our stocks. 'Phones: Kin. 1191/2 and 1595.

Files, 4", 6", 8", 10", 5s., 6s., 8s., 10s. per doz., assorted if required, in hand, flat square, 3-square round, and square bastard, smooth, 2nd cut warding or thin flat, 4 to 6", 5s. doz., carriage paid.—W. STACEY, Dept. M.E., 6, Mary Street, Sheffield.

Infinitely Variable Speed Gear, ratio 16 : 1, materials supplied, leaflet.—CROWTHER, 85, Charlotte St., Rochdale.

Sale, Myford 3½" Bench Lathe, complete, micrometer collars, 4" S.C. and independent chucks, faceplate, etc., all in new condition, £25.—HERBERT, Willoughby Waterleys, Leicestershire.

For Sale, Power Shaper on stand, 6" stroke, variable, 9" traverse, automatic rise and fall table, 6", perfect condition. Nearest £35.—MITCHELL, 22, Durham Avenue, Thorne, Doncaster.

Sale, Lorch 4" Watchmaker's Lathe, flat bed, self centralising chuck, compound slide-rest, 1/10 h.p. motor, £25.—HINE, 21, Belsize Park Gardens, London, N.W.3.

Send for New Comprehensive List and Samples. Hex. Steel Nuts, ⅛" Whit., 4, 5, 6 B.A., 3s. 3d. gross; 7, 8, 9d.; 8, 4s. 3d.; 9, 5s. 6d.; 10, 6s.; Brass, 4, 5, 6, 2s. 6d.; 7, 8, 10, 2s. 9d.; Ch/CS. Steel Screws, 3/32"-⅛" Whit., 4, 5, 6, 7, 8 B.A., ⅛"-½", 2s. gross; ¾"-1", 2s. 6d.; Flat brass, steel washers, 1s. gross; Stainless steel balls, 1/16", 5d.; 3/32"-⅛", 4d.; 5/32", 5d.; 3/16", 7/32", 6d. dozen; 16-g. Brass and copper sheets, 5s. 9d. sq. ft.; Brass rods, ⅛", 1½d.; 3/16", 2½d.; ¼", 5d.; 5/16", 8d.; ⅜", 11d.; 7/16", 1s.; ½", 1s. 2d.; Hex. square ex-stock; Steel flats, ¼" × 2", 1s.; ⅛" × 3", 1s. 7d.; ¼" × 3½", 2s. ft.; Iron m/s Rivets from 6d. gross; ⅛" sq. graphited yarn, 1s. packet; C.O.D. or cash with order. Satisfaction, or money refunded.—A. J. REEVES, 81, Cole Valley Road, Birmingham 28.

All Brand New Tools. Silver Steel, 13" lengths, rounds 1/32", 11s.; 3/64", 6s.; 1/16", 4s. 10d.; 5/64", 4s.; 3/32", 3s. 6d.; 7/64", ⅛", 3s.; 9/64", 5/32", 11/64", 2s. 9d.; 3/16" to ¼", 2s. 6d., all per lb. weight prices, any weight supplied; square, 1/16", 10s.; 5/32", 5s. 6d.; 3/16", 7/32", ¼", 9/32", 5/16", 5s. per lb.; H.S. Reamers, parallel, 3/32", 8s.; ⅛", 6s.; 5/32", 5s. 9d.; 3/16", 5s. 6d.; 7/32", 6s. 6d.; ¼", 6s. 6d.; 9/32", 6s. 9d.; 5/16", 6s. 9d.; 11/32", 7s. 6d.; ⅜", 7s. 6d.; 13/32", 8s. 3d.; ½", 10s.; H.S. Woodruff Cutters, No. 1, 12s.; 2, 12s.; 8, 15s.; 11, 17s.; 15, 19s.; 24, 36s.; H.S. Lathe Centres, M.T.1, 4s.; H.S. Half Centres, M.T.1, 5s. 6d.; H.S. Drills Wire Gauge, No. 1-2, 2s.; 3-6, 1s. 11d.; 6-11, 1s. 10d.; 12-16, 1s. 9d.; 17-19, 1s. 8d.; 20-24, 1s. 7d.; 25-29, 1s. 6d.; 30-32, 1s. 5d.; 33-42, 1s. 4d.; 43-48, 1s. 3d.; 49-52, 1s. 2d.; 53-80, 1s. 1d.; 1-57 mm., 1s. 1d.; 2-5 mm., 1s. 4d.; Twist Drills H.S., 1/64", 1/32", 3/64", 1s. 1d.; 1/16", 1s. 2d.; 5/64", 1s. 3d.; 3/32", 1s. 4d.; 7/64", 1s. 4d.; ⅛", 1s. 5d.; 9/64", 1s. 6d.; 5/32", 1s. 7d.; 11/64", 1s. 8d.; 3/16", 1s. 9d.; 13/64", 1s. 11d.; 7/32", 2s.; 15/64", 2s. 3d.; ¼", 2s. 5d.; 17/64", 2s. 7d.; 9/32", 2s. 9d.; 19/64", 3s.; 5/16", 3s. 3d.; 21/64", 3s. 6d.; 11/32", 3s. 9d.; 23/64", 4s.; ⅜", 4s. 3d.; 25/64", 4s. 6d.; 13/32", 4s. 9d.; 27/64", 5s.; 7/16", 5s.; 29/64", 5s. 3d.; 15/32", 5s. 6d.; 31/64", 5s. 9d.; ½", 6s.; H.S. Centre Drills, size 1, 1s. 4½d.; 2, 1s. 6½d.; 3, 1s. 9d.; 4, 1s. 11½d.; H.S. End Mills, 3/32", 8s. 6d.; ⅛", 8s. 6d.; 5/32", 8s. 6d.; 3/16", 8s. 6d.; ¼", 7s. 6d.; 5/16", 9s.; ⅜", 10s.; Engineers' or Motor Kits, in canvas, Roll Spanners, Pliers, Magneto Spanners, Copper Hammer, etc., set, 30s.; Chrome Ring Spanners Offset, Whitworth ¼" × 3/16" 4s. 6d.; 3/16" × ¼", 4s. 10d.; ¼" × 5/16", 5s. 3d.; 5/16" × ⅜", 6s. 6d.; ⅜" × 7/16", 7s. 9d.; 7/16" × ½", 8s. 6d.; ½" × 9/16", 9s. 9d.; 9/16" × ⅝", 11s. 6d.; ⅝" × ¾", 14s. 6d.; Combination Spanners, Ring and Open End, ⅛", 3/16", ¼", 5/16", ⅜", set 25s.; Set 7 Vanadium Spanners, ¼" to 9/16", 30s.; Dies, 13/16", 40 threads, 5/32", 3/16", 7/32", ¼", 9/32", 2s. 6d.; B.A., Nos. 0 to 6, 2s.; 7-8, 2s. 6d.; 9-10, 3s.; 11-12, 4s. 9d.; Whit. 1/16", 3s.; 3/32", 2s. 6d.; 5/32", 3/16", 7/32", ¼", 2s.; 9/32", 3s.; 3/16" 28, 3/16" 30, ¼" 24, 3s. 6d. each; 1" Dies, B.S.F., 5/16", ⅜", Whit. ½", 3s.; 32 thread, 5/16", ⅜", 5/16" 26, 4s.; Steel Dieholders, 1", 4s.; Tap Wrenches, ¼", 1s. 4d.; 1/16"-½", 3s. 6d.; Drill Stands, 1-60, 2s. 6d.; 1/16"-⅜", 2s. 6d.; Drill Chucks, ½", 10s. 6d.; 1/16" to ½", M.T. No. 1, 37s.; Taps, Semi H. Speed, B.A. 3, 5, 8, 9, 10, Whit. 3/32", 5/16", B.S.F. 5/16", 1s. 6d. each; 40 threads, 5/32", 3/16", 7/32", ¼", 1s. 6d.; 5/16", 3s.; ⅜", 3s. 6d.; 32 threads, ⅜", 2s. 3d.; 7/16", 2s. 9d.; ½", 3s.; Whit. 1/16", 1s. 6d.; ⅛", 5/32", 3/16", 7/32", ¼", 11d.; 5/16", 1s. 3d.; ⅜", 1s. 6d.; 7/16", 2s.; ½", 2s. 3d.; ⅝", 3s. 3d.; B.S.F. 3/16", ¼", 11d.; 5/16", 1s. 3d.; ⅜", 1s. 6d.; 7/16", 2s.; ½", 2s. 3d.; ⅝", 3s. 3d.; ¾" Gas, 2s. 6d.; B.A. 0-1-2-4-6, 11d.; 7, 1s. 2d.; Myford M type 3½" Lathe Spares, add 3s. in £ increased prices; Fixed Steady, 40s.; Travelling, 30s.; set 4 Faceplate Dogs, 2s. 6d.; sets Bolts, Nuts, 2½", 4s. sets 4; Bolts, 6", 6s. 6d.; 8", 8s. 6d.; 12", 11s. 6d.; Angle-plate, 4", 7s. 6d.; Change Gear Rack, 20s.; Circular Saw Table, £4 7s. 6d.; Boring Bar, 3 cutters, 20s.; Lathe Carriers, ½", ¾", 1", set 6s.; Myford Lathes, 3½", Drummond Bench type, £46 16s. 0d., equipment extra, add 3s. in £1 price increased, delivery 36 weeks; new type Myford M.L.7, 3½" Lathes, £35 15s. 6d., provisional price, bench model, 40-52 weeks delivery; Abrafiles, medium, coarse, fine, 9d. each; set Links, 4½d.; Paraffin Blowlamps, 1 pint, 24s. 9d.; Steel Stamps, A to Z, 1/16", 16s. 6d.; 3/32", 16s. 6d.; ⅛", 17s. 6d.; Unique Test Indicators, 5s.; Gauges, Radius, 6s.; Screw, Whit., 3s. 6d.; Pocket Scribers, 1s. 7d.; Toolmakers' Clamps, 3" jaws, 4s. 7d.; Steel Squares, 2", 4s. 3d.; 5", 5s. 4d.; Jenny Calipers, 5", 4s. 7d.; Spring Calipers, outside 6", 3s. 10d.; Dividers, 4", 3s. 1d., Depth Gauges, 6", 8s. 5d.; Screw-cutting Gauges, 2s. 8d.; H.S. Slitting Saws, 2¾" × 3 32", 6s. 3d.; 3" × 1/32", 7s. 3d.; 3" × 1/16", 6s. 3d.; 3" × 5/64", 6s. 6d.; 3" × ⅛", 7s. 3d.; 2¾" × .064, 5s. 9d.; 3" × .024, 6s. 3d.; 3" × .028, 6s. 3d.; 3" × .048, 6s. 3d.; 3" × .050, 6s. 3d. 3" × .064, 7s. (above 1" holes); Swiss Warding Files, 6", 2s.; 12" Flat Bastard, 2s. 5d.; 12" second cut, 2s. 6d.; 14" second, 3s. 3d.; H.S. Tool Bits, 3/16", 9d.; ¼", 1s.; 5/16", 1s. 10d.; ⅜", 4s. 4d.; ½", 7s. 3d.; Steel Tool Boxes, 18" × 18" × 9", 30s.; 14" × 7" × 7", 19s; Emery Wheels, 2" × 1/16", 11d.; 3" × 11/16", 1s. 3d.; 3" × ⅜", 3s. 5d.; 3½" × ½" 3s. 6d.; Carborundum, 4" × ½", 4s.; 3½" × ¾", 4s.; 7" × ½", 7s. 6d. (⅜" holes above); Diamond Glass Cutters, 25s.; Burnerd 4" Self-centring Chucks, £4 17s. 6d.; Micrometers, M. & W., 1" Ratchet Locknut, 36s. 7d.; Drill Gauges, 1-60, 10s. 6d.; 61-80, 13s.; Socket Spanner Sets, B.A., 0-6, 4s. 6d.; Hacksaw Blades, 12", 3d.; 10", 2½d.; Vee Blocks Clamp, 15s. 6d.; Automatic Centre Punches, 7s. 6d.; Pawson Tapper, M.T.1, 0-⅜", £9 7s. 0d.; Steel Bins, 36" × 9" × 9", 27s. 6d.; 36" × 6" × 6", 22s. 6d.; To Clear, Sets, H.S. Drills and Stand, 1 to 60, £2 8s. 6d. Note our present policy is post orders only. Advantage is you can inspect in your home. If not what you like, return same. Your money would be returned without question. Prompt service. Can supply now Ireland and abroad, etc. Post paid over 10s. Pay P.O.s, cheques to—S. GRIMSHAW, 7, Hall Street, Gorton, Manchester 18. (Warehouse), Gorton Lane, Gorton.

Watchmaker's Lathe, Wheel Chucks, Collets, Accessories, complete, £24; Self-feed Bench Drill, ½" capacity, with set Drills, £4 10s.—RIDDIOUGH, 376, Railway Street, Nelson, Lancs.

Sale, Quantity Small Tools, mostly new. S.A.E.—42, Blandford Road, Reading.

3" Portass B.G.S.C. Lathe, with countershaft, on wooden stand (2 shelves), suitable for self-contained drive, 15 Change-wheels, £25.—BIRD, 170, Russell Avenue, London, N.22.

Boley Lathe, 2⅜", no slide-rest, £10; ½" capacity precision bench power drill, £16; 10" bellows with torch, £2 10s.—HILL, 62, Leigham Vale, Streatham, London.

4½" Centre Winfield Lathe, complete on stand, with motor, new condition, £40. Wanted, 24" Hand Planer.—SAXTON, Machine Tool Maker, Fritchley, Derbyshire.

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Apex and New Atom Minor (Mr. Westbury's design). Engine castings of DTD 424, the famous alloy as used in Rolls Royce Aero engines, Sp. gr. 2.56. Tensile 9 tons, lighter and far stronger than die cast, with most attractive finish. Carburettor castings (described June 14th issue "M.E."), and spiral timing gears for Apex; Ball-races, piston rings, miniature plugs, contacts and other equipment. Send us your enquiries. Trade also invited.—THE HEADINGLEY MOTOR & ENGINEERING CO. LTD., 8, Otley Road, Leeds.

Pressure Gauges, ¾" and 1" diameter, with nut and liner, 150 lb., well-known make, 12s. 6d. each. Satisfaction or money back. Cash with order. Delivery 8 weeks certain.—S. GIRLING, 32, Barbara Road, Hall Green, Birmingham 28.

Wanted, Three-blade Propeller, 2" diameter and 1¾" pitch or near, new or good second-hand.—ELLIOTT, 210, West Derby Road, Liverpool.

Auto-cycle Engine, Two-stroke, enclosed flywheel, in-built magneto and silencer—no carburettor, unused. Buyer to collect, £3 10s.—H. MCLAUGHLIN, 6, Brookland Gardens, Roding Lane, Ilford.

2½" Gauge 4-6-2 "Fayette" and Tender, not completed, all drawings to complete; "O" gauge 6-8 volt D.C. Bassett-Lowke Flying Scotsman, in new condition; quantity of "O" gauge Permanent Track, Trucks, etc.; volumes of MODEL ENGINEER from 1937 to date. Offers. Can be seen after 7.—7, Millsmead Way, Church Hill, Loughton, Essex.

For Sale, 2½" gauge coal-fired 4-6-0 Olympiade, good workmanship throughout, £40; track trial arranged.—LIPPIATT, 53, Manor House Lane, Birmingham 26.

Stuart Sun Marine Engine, broken baseplate, 20s.; Marine centre flue Boiler, 8" × 3½", no fittings, except water gauge, 25s.; Petrol blow-lamp to suit, 10s.; Twin drum water tube Marine Boiler, 9" × 5", complete safety valve, stop valve, clack valve, 45s.; Stuart No. 10 Marine Engine, needs slight attention, 20s.; Pair davits, lifeboats, ventilators, telegraphs, binnacle and wheel, etc., 25s. lot, or offers, suit 36" tug. S.A.E.—WALTON, Beechgrove, Valley Drive, Ilkley.

Steam Plant, Stuart B.B. Engine, boiler copper riveted, lagged, 4½" diameter 11" long, centre flue cross tubes, superheater steam valve, safety valve, water gauge, pressure gauge, syphon clack, feed pump, whistle, blowlamp, good condition, £8 10s.; also Stuart 4 volt, 1 amp. Dynamo, £1.—J. PELL, 40, Longton Road, Blackpool.

"Hielan' Lassie," 3½" Locomotive, Frames, all wheels, bogie, trailing frame, connecting-rods, complete chassis finished, except valve gear, 3 P.V. cyls. for same, work excellent, extras, bargain, £25 10s. Offers. Model Petrol Engine, experimental, crankshaft intake, needs new crankshaft owing to timing fault, coil, condenser, no rubbish, £4. Offers.—14, Belmont Avenue, Southall, Middx.

"Hielan' Lassie" Castings. Materials to date. Stock. Some "Petrolea," "Ada."—A. BARTRUP, 4, Northview Drive, Woodford Green, Essex.

All Castings for "L.B.S.C's." 5" gauge saddle tank 0-4-0 locomotive. Write for list.—HOME ENGINEERS LTD., 17, Kings Road, Herne Bay, Kent.

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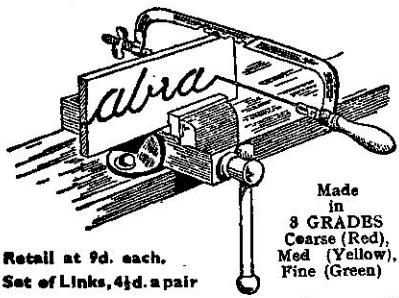

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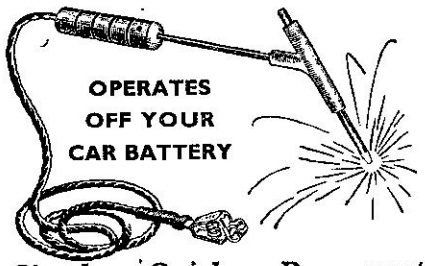

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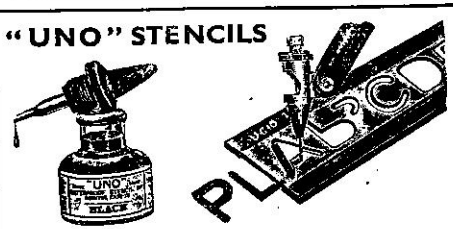

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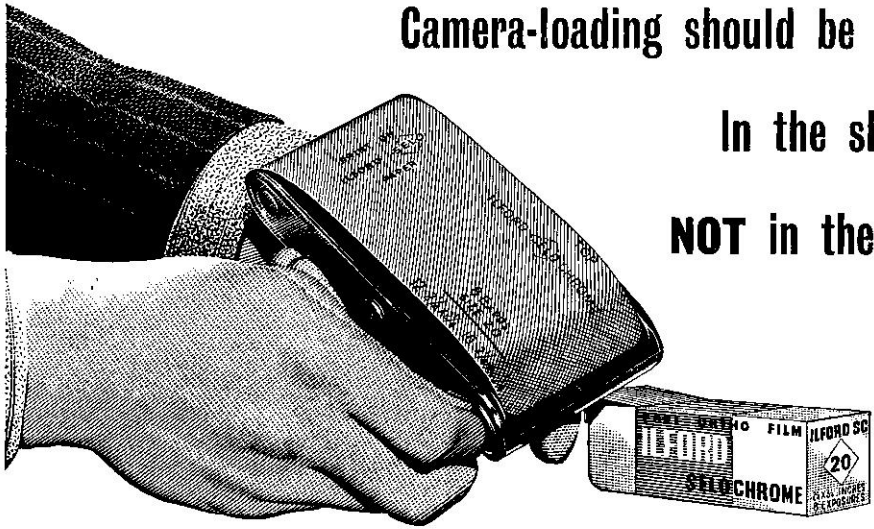

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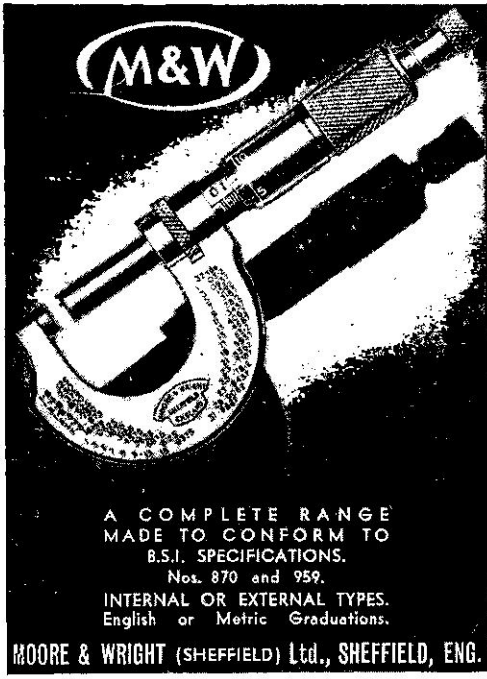

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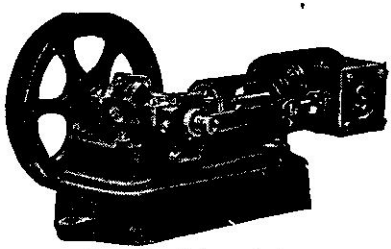

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